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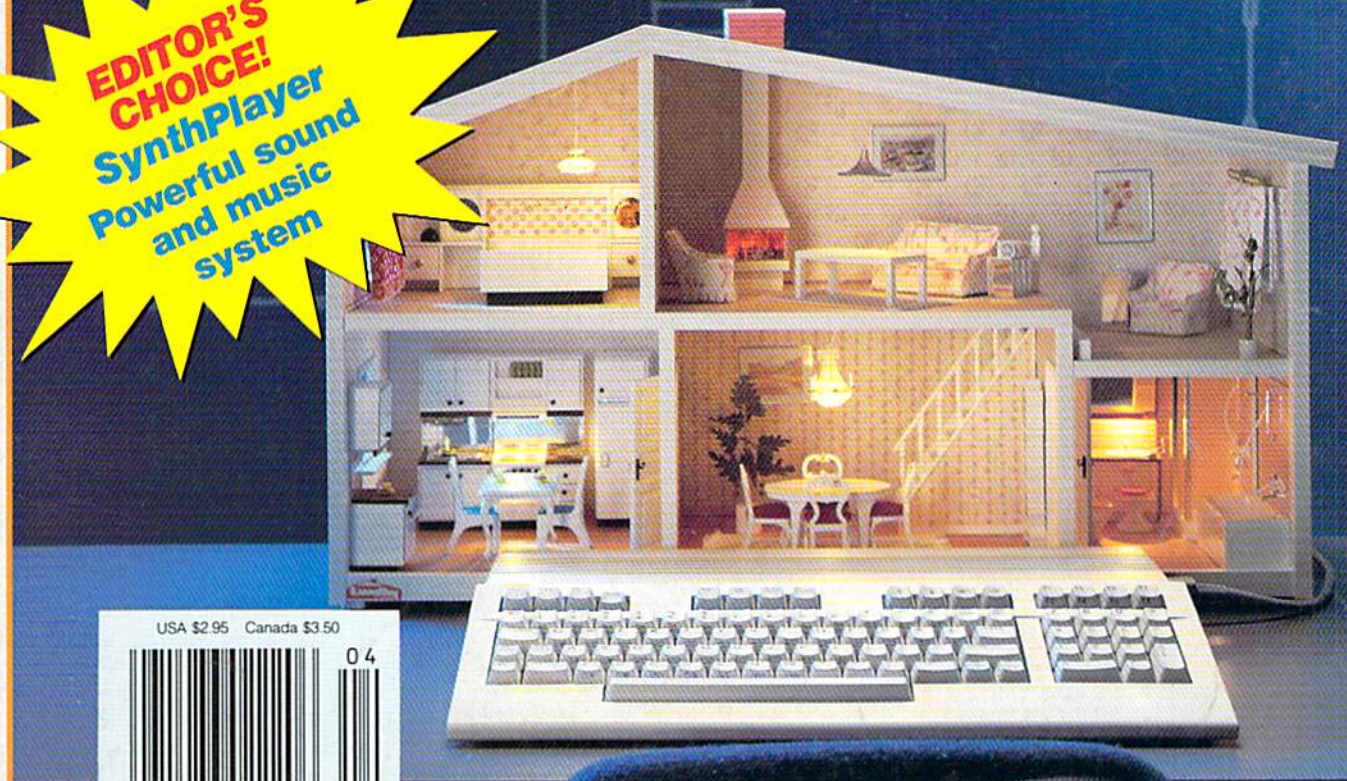

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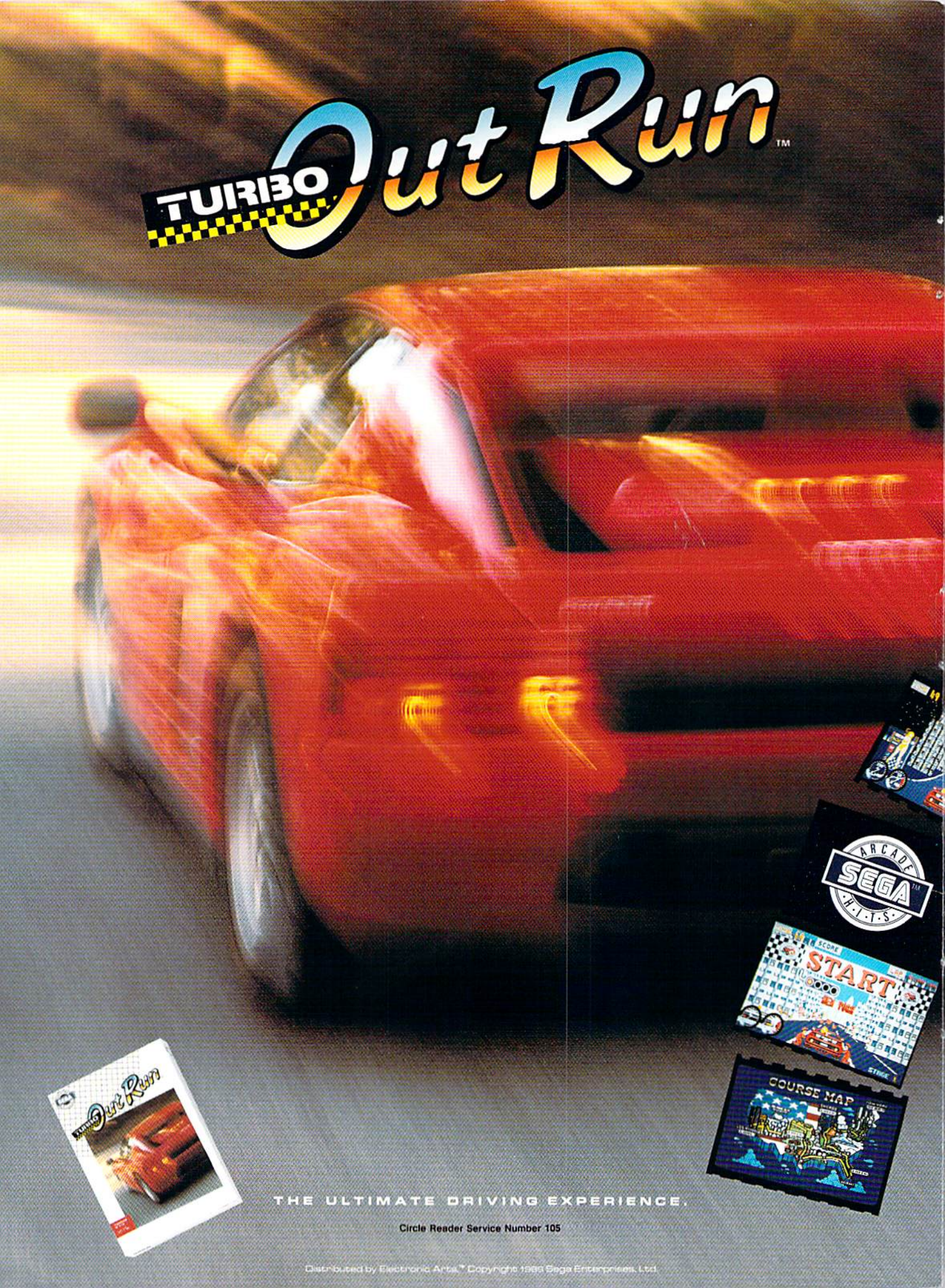

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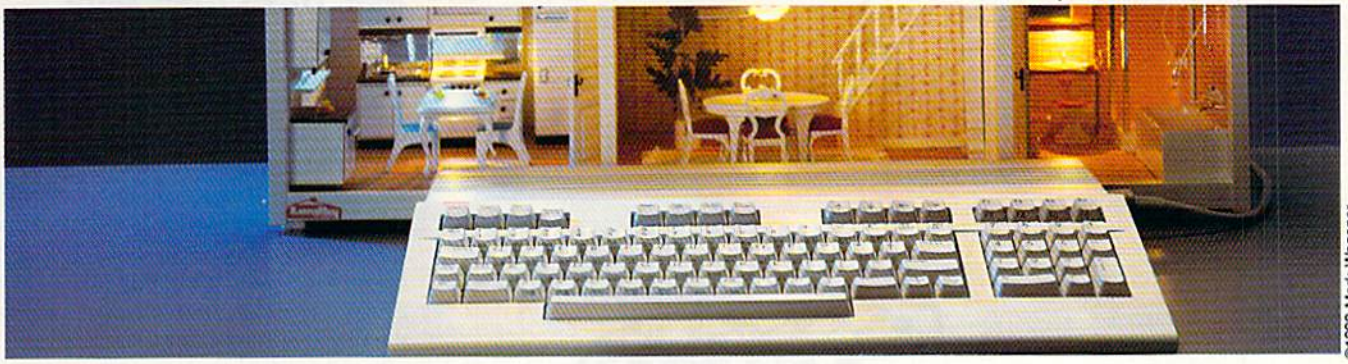

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COMMODORE CLIPS

NEWS, NOTES, AND NEW PRODUCTS

Edited by Mickey McLean

Commodore Bundles Up for Winter

The 1990 Winter Consumer Electronics Show held in Las Vegas this past January offered a few surprises for the Commodore 64 user, including one from Commodore itself.

Commodore (1200 Wilson Drive, West Chester, Pennsylvania 19380) took this opportunity to introduce a repackaged 64. The Commodore Test Pilot ($499), a startup package designed for first-time computer buyers, includes a 64C computer, a 1541 disk drive, a joystick, and five games bundled together in one package. Also included are step-by-step setup and operating instructions.

Test Pilot was intended for the Christmas selling period, but it wasn't ready in time for nationwide distribution. The package was initially released in a limited number of markets but should now be available across the country through mass-market retailers such as Toys "R" Us and Hills.

The five games included in Test Pilot are *Advanced Tactical Fighter, Infiltrator III, Harrier, Crazy Cars,* and *Tomahawk.*

Commodore also announced plans to release a similar education package that will feature five educational programs bundled with a 64C. The release date for this hardware/software combination has been set for early summer.

For more information on where to find Test Pilot, call Commodore at (800) 627-9595.

Supergame

You can help Superman fight for Truth, Justice, and the American Way with *Superman: The Man of Steel* ($29.95) from IntraCorp (14160 SW 139th Court, Miami, Florida 33186) and its Capstone line of entertainment software.

In this interactive comic book, you become Superman, who is racing to save the planet. Two of your most hated enemies, Darkseld and Lex Luthor, have aligned, and terrorists have hijacked a yacht with the Governor and Lois Lane on board. You must use your x-ray vision, strength, and flight to foil your nemesis and save the world from destruction.

Three in One

Sir-Tech Software (P.O. Box 245, Charlestown Ogdensburg Mall, Ogdensburg, New York 13669) has released the *Wizardry Trilogy* ($39.95) which includes *Wizardry I: Proving Grounds of the Mad Overlord, Wizardry II: Knights of Diamonds,* and *Wizardry III: Legacy of Llylgamyn.*

New Titles from Taito

Taito (267 West Esplanade, North Vancouver, British Columbia, Canada V7M 1A5) has unveiled four new titles for the 64.

In *New Zealand Story* ($29.95), Tiki the kiwi pursues an agitated seal who has kidnapped Tiki's kiwi friends from the zoo. You must assist Tiki in his mission by helping him leap, climb, fly, and swim his way to save the day while avoiding arrows and other obstacles.

Chase H.Q. ($29.95) is a conversion of a coin-operated arcade game where you play the role of a cop on patrol. Headquarters notifies you of a criminal on the run and advises you of his location. Your job is to track him down and bring him in, but the road ahead is full of trouble.

Operation Thunderbolt ($29.95), the sequel to *Operation Wolf,* sends Roy Adams, commando of *Operation Wolf,* to infiltrate a hostile African country and free 23 hostages. The game features three-dimensional forward-scrolling graphics and a simultaneous two-player option.

In *Ninja Warriors* ($29.95), a deposed ruler, who retreated with a group of loyal scientists, has returned to fight with a half-human, half-machine martial arts fighter called the Ninja Warrior. You can select from several ninjas and employ their abilities to move and fight with weapons.

Magic Released

Virgin Mastertronic (18001 Cowan, Suites A & B, Irvine, California 92714) has released *Magic Johnson's Basketball* ($14.99) for the 64. This one- or two-player game features full-court scrolling action complete with a referee to whistle fouls on you or your opponent. To add to the realism of the game, player statistics are updated after each game. ▷

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COMMODORE CLIPS

NEWS, NOTES, AND NEW PRODUCTS

Games on CD for the 64

Camerica (80 Orville Drive, Suite 202, Bohemia, New York 11716), maker of computer joysticks, announced at CES a new product that makes use of your compact disc player for something besides listening to music. You can now play Commodore 64 games through your CD player with the CD Games Pack ($49.95).

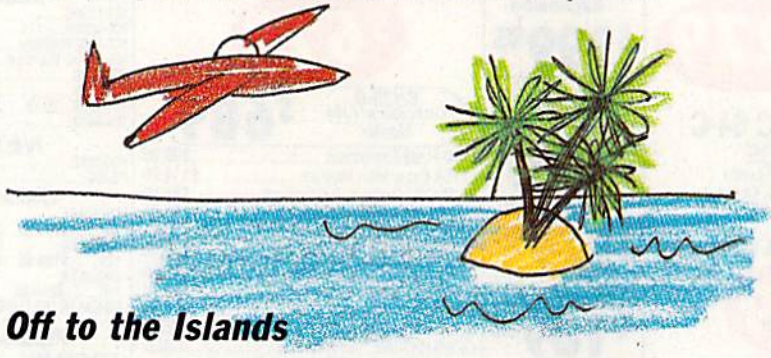
The package includes an interface and a CD filled with 30 arcade games. The system connects your Commodore 64 to either your CD deck or to a portable CD unit, and it works on the same principle as a tape drive. The interface plugs into the 64's cartridge port, while a wire leading from the interface plugs into your CD player's headphone jack.

To play a game, simply insert the game disc into your CD player, press the reset button on the interface cartridge, and select a game by track number, just as you would select a song from an audio CD. The game files are then sent to the interface cartridge where the CD's digital signal is converted into an analog signal that the 64 can read. Software in the cartridge speeds up the loading process.

The CD Games Pack does not improve gameplay, but its medium allows for more storage. A typical compact disc can hold up to 150 games designed for an 8-bit computer.

The 30 games included on this initial release are arcade hits from Europe put together by Code Masters Software of Great Britain. More European games may be released on CD in the near future. Camerica also plans to approach American software publishers and obtain the rights to release their past hits on compact discs.

Camerica anticipates a midsummer release date for the product.



Take Off to the Islands

You can explore a tropical paradise with *Hawaiian Odyssey Scenery Adventure* ($29.95) enhancement disk for any SubLOGIC (501 Kenyon Road, Champaign, Illinois 61820) flight-simulation program, including *Flight Simulator II*, *Jet*, and *Stealth Mission*.

The disk covers the entire island chain in detail including downtown Honolulu and Pearl Harbor on the island of Oahu. You can also fly into the crater of Mauna Loa, one of Hawaii's most volatile volcanoes. The 400-mile-long Hawaiian Island chain contains approximately 30 airports, many with Visual Approach Slope Indicator landing lights. Improved runways feature FAA-spec threshold markings, fixed-distance markers, and touchdown-zone markers.

The disk also offers the first SubLOGIC scenery adventure. You must locate the secret jewel of the goddess Pele from the cockpit of your airplane. First, you must find and follow a set of clues scattered about the islands. Once you determine its location, the jewel is only visible under a strictly defined set of conditions. If you make a mistake, you might never find your way back.

Hawaiian Odyssey Scenery Adventure requires one of the flight-simulation programs mentioned above.

Ghosts, Ghouls, and Great Racing

Activision (Mediagenic, 3885 Bohannon Drive, Menlo Park, California 94025) has announced three new titles for the 64.

Based on last summer's movie hit, *Ghostbusters II* ($29.95) requires you to collect slime and take the Statue of Liberty for a walk down the streets of New York City. At the Museum of Modern Art, you must save the city from Vigo the Carpathian, the ultimate evil spirit.

Grave Yardage ($24.95) represents what would have happened to the NFL if Boris Karloff had been named commissioner. You must use claws, knives, clubs, and energy blasts to tackle goblins, ogres, zombies, ghouls, and other strange creatures. As a member of the Monster Football League, you choose your own monster lineup, make substitutions for the dead and dying, call the plays, and design the field, complete with land mines.

Based on the coin-operated arcade game from Sega, *Power Drift* ($39.95) takes you racing on five different roller-coaster tracks and courses, each with increasing difficulty. Races last four laps, and you'll be pitted against such opponents as Jason the Skinhead and Jeronimo the Mohican. Points are earned by finishing the race with the best time possible. A finish in the top three allows you to advance to the next level.

Taking It to the Streets

Clean up the streets of New York with *Vigilante* ($24.95) from Data East (1850 Little Orchard Street, San Jose, California 95125). The game is based on the coin-operated arcade game developed by Irem.

As a vigilante, you must fight for the freedom of a girl kidnapped by a street gang. You must use your martial arts skills to succeed in this one-player game. G

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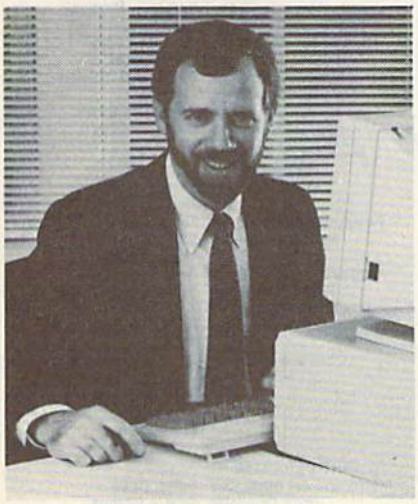

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EDITOR'S notes

First prize for Most Reader Mail here at COMPUTE! goes to *Gazette*. Of our four publications, it wins the award by a long shot. We don't count the number of letters *Gazette* receives, but our best guess is about 300 per month. While some of the letters find their way into the magazine, most don't—and obviously can't. We try to answer some mail personally, but, with the realities of delivering a disk and magazine every 20 working days, too many letters go unanswered. We do manage, at least, to read every letter.

I'm looking over a stack of letters now and wondering how to respond to some of the questions people ask. Here are a few examples.

I've written you three times and still haven't received an answer. I had a list of ten questions, and none of them were answered in the last few issues. I also happen to have my renewal form for your magazine in front of me. I might renew if I hear from you. Hoping to hear from you SOON.

I recently purchased an old (42 years) Westinghouse icebox and I'm in the process of rebuilding it. I want to experiment with different parts. What I want from you is advice on how I can hook up my 64 to it so that I can monitor the icebox components. I want to test how efficient the icebox is on different settings.

Can you give me all the names and addresses of persons who write programs for the Commodore 64?

I own a Korg DS-8 digital synthesizer (with MIDI), a Roland Rhythm Composer TR 707 (with MIDI), a Kawai KM-60 Monitor (with MIDI), a 128, a 1571, and a 1902 monitor. How can I connect all these things together to play, edit, and record my songs? What do I need?

OK, folks, you be the editor. How would you answer these readers? We get a lot of hardware questions like the icebox and synthesizer letters above—people want to know how to do all kinds of things with their 64s. Most hardware questions concern printers and interfaces. Unfortunately, we don't have all of the equipment that some of our readers have, so we can't duplicate configurations for research purposes. More unfortunate is that a lot of hardware (printers, interfaces, and 42-year-old Westinghouse iceboxes in particular) has been out of production for years, so we have no way of even getting our hands on some units.

One way we can tell you how innovative users are working with their 64s and 128s is to offer features like "All Around the House," this month's cover story. *Gazette* runs this kind of story several times a year (see "The 64—Hot or Cold?" in our February issue). And if you follow the "Letters to the Editor" column, you know that we frequently run requests for help from readers. I'm always amazed at how many of you quickly respond to offer assistance. Reader involvement is one of the major reasons *Gazette* is such a valuable resource to the 64/128 community.

****

We recently visited the annual Winter Consumer Electronics Show in Las Vegas. If we had run a feature story on the show, the headline would have been something like "Videogames Rule the Roost!" The amount of floor space consumed by hardware and software from Nintendo and Sega was tremendous. We expected to see very little in the way of new 64 titles—after all, if it's not new videogames we hear about, it's MS-DOS or Amiga products—but we were pleasantly surprised. Our "Commodore Clips" editor, Mickey McLean, was at the show and has covered a number of the new products in this month's column. He'll have more in next month's "Clips."

Lance Elko
Associate Publisher

COMPUTE!'s GAZETTE FOR USERS COMMODORE 64/128

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LETTERS to the editor

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LQ Printouts from GEOS

I've been plagued for some time by the lack of real letter-quality printout capabilities from GEOS. The other day, I found a solution. If you are fortunate enough to have a printer that can be locked in its near-letter-quality mode (I have a Star NX-1000 Rainbow, which can be), you can lock it and request a draft printout from GEOS. I don't know about other versions, but with 2.0 for the 128, what you get is what you see. There are drawbacks: In draft mode, GEOS ignores all text enhancements and centering (tabs, however, are recognized).

I read "The GEOS Column" every month and have found some of the suggestions and programs very helpful but have never found this hint. I hope it helps some of your readers.

Garry Modlens
Portsmouth, VA

Most printers allow you to send escape sequences to select the type style in which they normally print. Some printers, like Garry's Star NX-1000, have control panels which allow you to select the type style that the printer will use. Unfortunately, most printers can't prevent software from changing that type style; the NX-1000 allows you to lock in a specific type style by pressing a button when you turn on the printer. Other printers require you to send an escape sequence. You need to refer to your printer manual to determine whether your printer has any locking capability.

Book Wanted

For more than a year, I've been looking for a copy of *Programming the Commodore 64 (Revised): The Definitive Guide* by Raeto West. If anyone is interested in selling his or her copy, I am willing to pay full cover price ($24.95) if it's in reasonably good condition.

David Etzel
Shippenville, PA

Here's another COMPUTE! book that's long out of print. All we've got here at the office are a few dogeared copies. If there's a reader out there who is willing to sell David a copy, let us know—we'll forward your letter to him. By the way, there are still several other good book titles available. For details, see page 67.

Track Down

Greetings from a Tarheel temporarily residing deep in Dixie. (Are any of you guys really Tarheels, anyway?) In regard to John Mahoney's letter ("Vehicle Tracks") in the February issue, I have an answer: Timeworks' *Data Manager 128* is what he's looking for. In addition to being a good and easy-to-use database, it allows calculations. Hope this helps.

Carl E. "Buddy" Grohs
Bay Minette, AL

Thanks, Buddy. (By the way, about half of the staff here at COMPUTE! would qualify as native Tarheels.)

In reference to "Vehicle Tracks," I'd suggest *ValueCalc,* published by Melody Hall, for use with the 64 and 128. One of the programs in this inexpensive disk package is Gas Mileage Calculator, and it can be easily adapted to include all vehicle-related expenses. (The only serious bug I've encountered so far is a lockup after I issue a SAVE command; I have to reload and start over.)

Bill Breese
Albany, OR

Following Bill's lead, we contacted Melody Hall. A spokesperson verified that ValueCalc *is still available and that it sells for $6.95. Interested readers may contact the publisher at the following address: Melody Hall Publishing, P.O. Box 1567, Northbrook, Illinois 60065.*

John Mahoney should check out the public domain program MECH AID V.64.7. Various user groups should have a copy. The program handles two vehicles.

James E. Lambert
Hastings, NE

Parental Approval

My mom and dad don't understand why I like to use my 64. They say I'm on it too much, and they really hate my modem. I'd like to prove them wrong. Is there anything I can buy or make that does some job or makes something easier? I have things for my printer, but that's not what I'm looking for.

Scott Davis
Bloomington, IN

Nice timing, Scott. This issue's cover story, "All Around the House," might provide you with some ideas.

Plus/4 Source

In response to your call for Plus/4 software, Nearlyfree Software (Box 223, Spearfish, South Dakota 57783) has a listing of 40 disks full of Plus/4 titles. Included are games, utilities, and educational and financial programs. The price is $3.00 per disk. I have purchased several and have not been disappointed.

Wiley F. Wood Sr.
Elizabeth City, NC

On the Road Again

I purchased my 64 in 1983. My system (my original 64, an FSD-1 disk drive, black-and-white TV, and a 1525 printer) is used to keep a running inventory for a small, mobile retail business (roadside sunglasses stand) that my husband and I operate. Since we are living full-time in a 23-foot travel trailer, this equipment must be packed and unpacked after each use. Even in these cramped quarters, I've managed to save the programs and important articles from many years of your issues. Keep up the good work.

Doreen Saffeels
Gig Harbor, WA

Thanks, Doreen, wherever you are.

CP/M Source Revisited

I'd like to inform all 128 owners of the perfect source for CP/M software: Poseidon Electronics. The company's latest catalog is yours on request. Contact Poseidon at 103 Waverly Place, New York, New York 10011. CP/M software is very hard to come by, and Poseidon is the best place to get it.

J. Lee Page
Tazewell, VA

We've mentioned Poseidon several times in Gazette *over the years, but we haven't plugged the company lately. You're right, Poseidon is an excellent source of CP/M software. We should note that the company carries some 128-specific CP/M software as well as 64-specific software for those with the 64 CP/M cartridge.* **G**

feedback

Do you have a question or a problem? Have you discovered something that could help other Commodore users? We want to hear from you. Write to Gazette Feedback, **COMPUTE!'s Gazette,** *P.O. Box 5406, Greensboro, North Carolina 27403. We regret that, due to the volume of mail received, we cannot respond individually to programming questions.*

Disk Inventory Query

In the December 1989 issue of *Gazette*, the menu for the program *Disk Inventory* has a SAVE AS AN ASCII FILE option but offers no corresponding LOAD option. Have I missed something?

A. C. Morrison
Turlock, CA

This program for the 64 lets you inventory a series of disks by filename and then sort, display, or print out the resulting list. As you mentioned, there's also an option to save the inventory list to disk as an ASCII file. This option was added to the program so that, if you wished, you could make changes to the list using a word processor before you print it out (from the word processor). Of course, to do this, you'll need a word processor that can load files that are in ASCII format (sequential files).

128 Highlight-Bar Menu

In the "Feedback" column for October 1989, there is a 64 program listing for a highlight-bar menu. This got me to thinking that maybe there were some people out there who would like a similar automatic menu for the 128's 80-column mode. So, I've written the following BASIC menu program.

```
RD 10 REM 128 HIGHLIGHT BAR MENU
JC 20 M$="PLACE YOUR HEADING INS
      IDE THESE QUOTATION MARKS!
      "
FG 30 GRAPHIC CLR:GRAPHIC 5
PK 40 FAST:SCNCLR:TRAP 510:COLOR
       6,7:COLOR 5,5
MP 50 CHAR,0,1,CHR$(111):CHAR,78
      ,1,CHR$(112):CHAR,0,23,CHR
      $(108)
JR 60 CHAR,78,23,CHR$(186):FOR C
      =1 TO 77:CHAR,C,1,CHR$(183
      ):CHAR,C,23,CHR$(175)
PD 70 NEXTC:FOR C=2 TO 22:CHAR,0
      ,C,CHR$(116):CHAR,78,C,CHR
      $(167):NEXTC
BE 80 COLOR 5,4:DIM A$(18),C(18)
QJ 90 CHAR,0,0," 128 SYSTEM ON #
      1{12 SPACES}COMMODORE
      {2 SPACES}128{2 SPACES}MEN
      U{14 SPACES}64 SYSTEM ON #
      3 ",1
JP 100 CHAR,0,24,"{5 SPACES}USE
       {SPACE}SPACE BAR TO SELEC
       T A FILE{2 SPACES}:::::
       {2 SPACES}PRESS RETURN TO
        LOAD A PROGRAM{5 SPACES}
       ",1
ES 110 M=LEN(M$):N=M:M=M/2:M=INT
       (M):M=40-M
AD 120 COLOR 5,8:CHAR,M,2,M$:COL
       OR 5,3:CHAR,M,3:FOR A=1 T
       O N:PRINT CHR$(184);
MD 130 NEXTA:A=1:F=5:E=12:COLOR
       {SPACE}5,14
GG 140 READ A$(A):IF A$(A)="-" T
       HEN 180
SE 150 G=G+1:C(A)=LEN(A$(A))
FG 160 CHAR,E,F,A$(A):IF E=12 TH
       EN E=45:ELSE E=12:IF E=12
        THEN F=F+2
MA 170 A=A+1:GOTO140
JB 180 A=1:F=5:E=12:COLOR 5,5
EH 190 IF A=G+1 THEN A=1:F=5
HK 200 CHAR,E-4,F," => ":CHAR,E+
       C(A),F," <= "
JC 210 FOR D=E TO E+C(A):CHAR,D,
       F+1:PRINT CHR$(184):NEXTD
RP 220 GET Z$:IF Z$="" THEN 220
GG 230 IF Z$=CHR$(32) THEN 280:R
       EM SPACE BAR
AF 240 IF Z$=CHR$(13) THEN 430
RR 250 IF Z$="1" THEN 400
JF 260 IF Z$="3" THEN 360
MF 270 IF Z$<>"" THEN 220
MH 280 H=H+1:CHAR,E-4,F,"
       {4 SPACES}":CHAR,E+C(A),F
       ,"{4 SPACES}"
SB 290 FOR DC=E TO E+C(A):CHAR,D
       C,F+1:PRINT " ":NEXTDC
PA 300 IF H=G THEN 350
DQ 310 A=A+1
QJ 320 IF E=12 THEN E=45:ELSE E=
       12
PG 330 IF E=12 THEN F=F+2
SP 340 GOTO 190
RH 350 A=1:F=5:H=0:E=12:GOTO190
GJ 360 SCNCLR:COLOR 5,2:COLOR 6,
       1:SLOW
GP 370 PRINT "YOU ARE NOW IN THE
        64 SYSTEM MODE. "
SF 380 PRINT "SET YOUR MONITOR T
       O THE 40-COLUMN MODE."
MB 390 GO64
PK 400 COLOR 5,2:SLOW:SCNCLR
EX 410 END
KJ 420 RESUME
QF 430 SLOW:SCNCLR:COLOR 6,1:COL
       OR 5,2
RH 440 RUN(A$(A))
BF 450 DATA PROGRAM 1:REM YOU MA
       Y HAVE UP TO 18 DIFFERENT
        PROGRAM NAMES HERE
QX 460 DATA PROGRAM 2
PR 470 DATA PROGRAM 3
QC 480 DATA "-"
```

Anyone can use the program without knowing how it works. To substitute your own menu heading, change the definition of M$ in line 20. To add your own programs to the menu, change the contents of the DATA statements at the end of the program.

If you make this program the first file on a disk, you can press SHIFT-RUN/STOP to load and run the menu. For added flexibility, I generally use several menus on the same disk. I use one menu as the main menu and access the others from it.

John R. Fisher
Kokomo, IN

This program is a real timesaver. We're sure our 128 readers will appreciate it.

The 64 Bible

I have a fear of missing out on some tidbit of information for the Commodore 64. That's why I subscribe to your magazine as well as every other C64 magazine. Even so, I get the feeling that somewhere there exists a compendium of information on the 64 that serious programmers must possess and that people like me are fed little dribbles from this "good book" every month.

As for available literature, you publish through COMPUTE! Books a bunch on PEEKs and POKEs and machine language. Yet, I keep finding unmentioned PEEKs and POKEs in programs, as well as SYS calls to Kernal routines, that I can't decipher. Even Commodore's own *64 Programmer's Reference Guide*, which I should think would be the last word on the subject, fails to mention many of these.

So, my question is this: Where the heck can I get ALL of the information on the 64 in one source? Where is the 64 bible?

Ben Johnson
Adjuntas, Puerto Rico

No book contains all there is to know about the 64. However, an informal survey among the magazine staff revealed that far and away the most popular book on this subject is Sheldon Leemon's Mapping the Commodore 64 and 64C *from COMPUTE! Books.* The Anatomy of the Commodore 64 *from Abacus Software comes in a distant second.* Mapping *describes how most of the 64's important memory locations are used by BASIC, the operating system, and the input/output chips. Appendix A of* Anatomy *contains a commented disassembly of the 64's Kernal and BASIC ROMs. Together, these two come very close to being the 64 bible.* **G**

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d'iversions

A Telepresence in Cyberspace

Fred D'Ignazio

William Gibson, in his award-winning novel *Neuromancer* (Ace, 1985), writes about a future world in which keyboard cowboys can plug into global computer networks and "ride" their computers like galloping horses through three-dimensional *cyberspace.*

Traveling through cyberspace is the out-of-body experience that mystics and New Age believers have been searching for. Actually, cyberspace and a related concept, *cybertime,* are nothing new. Whenever you talk on the phone, you are traveling through cyberspace; whenever you correspond with someone via electronic mail, you are voyaging through both cyberspace and cybertime.

Journeys of this sort used to be nothing more than acts of imagination. Thanks to computers and telecommunications, they're real.

Think about what it takes to correspond by paper with someone who lives far away, say, your sister. As you write to her, you are imagining that she is in front of you and you are talking with her. When you receive a return letter from her, you use the same mental model. You imagine that she is physically nearby and the two of you are having a conversation. If your imagination is especially vivid, you can see her face, hear her voice, and even describe what she is wearing. What you are imagining is a *telepresence*—a person who is physically remote but who appears to be nearby.

In telephone conversations, the experience of telepresence is real but monosensory. You can't see the other people; they can't see you. You can't touch them (despite what AT & T says), and they can't touch you. But you can hear them, and they can hear you. And after a conversation, you have this uncanny feeling that the distance between you is just a state of mind and that you could really reach out and touch the person at the other end of the line.

Virtual Reality

Time and space displacement are getting to be commonplace and convenient. For example, I used to play phone tag with business contacts. I'd call, and they'd be out. Then they'd call, and I'd be out. This sort of runaround might last for days. Now I've switched to fax and electronic mail. I write a letter to someone and—zip!—it's in his or her mailbox in an instant. Or I send someone a fax, and the paper rolls into his or her office moments later.

We are not in the same place at the same time; we are not even in different places but in contact at the same time. Yet we still manage to carry on a conversation. And we think nothing of it!

Similarly, I used to miss my favorite TV programs because I was busy, or I had to take the kids somewhere, or the programs came on too late for me to watch. Now I just set my VCR, and—voilá!—I come back a while later, and the VCR has captured my program.

> *We are witnessing the birth of a new form of reality.*

This sort of time and space displacement is growing commonplace, but it is really quite amazing. Even more amazing is the way we nonchalantly accept it. Do we ever think what all this is doing to our minds?

What we are witnessing is the birth of a new form of reality—*virtual reality.* In a world of virtual reality, people don't need to witness things in person to be a part of them. They can participate in events, occasions, and in each other's lives even though they are remote—in time, in space, or both.

We've been living through a fragment of virtual reality for years, from the development of writing to the invention of the printing press, the wireless, radio, TV, satellite communications, fiber optics, and so on. This is the one-way world of *spectator virtual reality.* Events can take place on the other side of the globe, and we can experience them via the newspaper, listen to them on the radio, or watch them on TV. As technology has become more powerful, our "tele-experiences" have become multisensory and we've been able to live through these remote experiences in realtime. Americans in the 1940s listened to World War II on the radio; in the 1960s we watched the Vietnam War on TV. In the 1980s we experienced global events—the Beijing massacre, the Northern California earthquake, the revolutions in Eastern Europe—as they occurred, with more information, more vividness and meaning, than did many of the participants who experienced the events firsthand.

Live, In Person

With the invention of computers and two-way mass telecommunications, we are now entering a new era—an era of *participatory virtual reality.* Not only can events and persons be broadcast into our lives, but we can reciprocate. They can touch us, we can touch them—through sounds, images, and voices. We can also enter the world of cybertime and experience events outside of realtime, even as we can now experience them remotely in real space.

For example, I've never met Hulio, a seventh grader at an inner-city school in Memphis, Tennessee. But two years ago, when Hulio was only in fifth grade, he visited my living room in East Lansing, Michigan. Physically, Hulio never left his classroom; but his *telepresence,* in the form of his image (digitized on his classroom computer and transmitted by modem to my computer) appeared on my computer monitor. The experience was extraordinary. Perhaps because of the expression on Hulio's face—his eyes, his smile—I felt he was really there with me. I responded by digitizing my ten-year-old daughter, Catie, and instantly transmitting her image and one of her poems to Hulio and his classmates in Memphis.

Another example of *mutual telepresences* occurred when we invited the famous science-fiction writer Isaac Asimov to be our teacher for a day in a high-school classroom in San Jose, California. Asimov, who hates to fly and who would never consent to visiting us in person, was sitting in a studio in Manhattan, just a few blocks from his apartment. The students and I were sitting in a classroom at the other end of the continent. But we were mutual telepresences—we became real to Asimov; Asimov became real to us.

Next month, I'll continue exploring virtual reality with you, and I'll describe a telewedding and telechristening that my family and I created recently. **G**

horizons

Here's the News

Rhett Anderson

Have you ever noticed that computers are in the news all the time? Give me a decent-sized daily newspaper, and I'll find at least one story that has something to do with computers.

As I write this, computers are all over the news. Hackers on trial. IBM falling from grace on Wall Street. Apple posting losses. Viruses attacking computers. (It all sounds like bad news, doesn't it? It must be true that good news doesn't sell.)

Those of you who followed the Nintendo-versus-64 debate might be interested in an article by L. Gordon Crovitz in the *Wall Street Journal* (Wednesday, January 17, 1990). Your local library may have it on microfilm.

The article discusses the lawsuits and political maneuvering going on between Nintendo and Atari. But not Jack Tramiel's Atari. The grand old man of the 8-bit Commodore bought the computer division, not the coin-op game division, which is doing the suing.

As an aside (it's getting confusing already), it's been alleged that Jack Tramiel squeezed Epyx out of business and took over the Handy hand-held game system, which became the Atari Lynx. The Lynx makes Nintendo's GameBoy look like last year's Cheez-Whiz, but Atari had problems getting enough color LCD screens, so the GameBoy got a head start. That's the problem Tramiel's Atari is having with Nintendo. Now back to the other Atari.

Atari Games has a subsidiary named Tengen. Tengen was a Nintendo licensee. But Atari doesn't like the way Nintendo operates. Nintendo game cartridges must contain a proprietary chip. Since Nintendo is the only producer of this chip, it's able to control the quality of the games produced for the NES. Tengen found a way around the system (I assume by reverse-engineering the chip) and decided to release its games. Evidently, it figured it might as well also sue Nintendo in a preemptive strike. The grounds for the suit was that Nintendo is a monopoly and is a racketeering enterprise.

In his article, Mr. Crovitz makes the point that if this is a monopoly, it's a strange one. After all, Nintendo created the current videogame boom despite the mess that Atari left behind. Remember when Atari was the dominant force in the market? And there's nothing to stop Atari from creating a new game machine that employs a lockout chip.

Now, the reason I bring this up is that there's a rumor going around that Commodore has been showing a game system based on the Amiga 500. It's clearly too late to base a game system on the 64. That's something Commodore thought about way back when it released the 64. There's even a POKE you can do to place the 64's memory into Max configuration (Max was, evidently, the working name for the game machine). The 64 can't possibly compete as a new game system against the superior graphics and sound of the Sega Genesis and NEC TurboGrafix. (But see "Commodore Bundles Up for Winter" in this issue's "Commodore Clips" for Commodore's alternative to a 64 game machine.)

The real surprise to the Amiga game system is that it includes a CD player. I suppose the machine will include the capability of overlaying computer graphics on live-action CD video. It will doubtless include CD audio. Wait, did I say that was the real surprise? I was wrong—here's the real surprise: Early reports have the cost at $600! Would you pay $600 for a game machine? Commodore, this had better be good.

It Happens to the Best of Us

AT & T had a computer problem. A programming bug convinced the call-switching network that the system was overloaded. Long-distance callers were greeted by the message "All circuits are busy. Please try your call again." Supposedly, most callers were able to get through after a few calls, but I gave up after about six tries. Interested in the problem (I had no idea it was national), I waited on the line for a while and heard a number—something like 63782. It reminded me of the Macintosh's system error number and the Amiga guru number. Perhaps AT & T uses the number for debugging purposes.

The CEO of AT & T held a press conference the next day and then showed up on the "MacNeil/Lehrer NewsHour" to explain that he was very concerned. He should be. His company's advertisements go on and on about AT & T's reliability. The competition (US Sprint and MCI) declined to pick on the phone giant, perhaps fearing that future snafus of their own would come back to haunt them.

David Letterman's Top Ten new slogans for AT & T included the provocative "Let your fingers do something else."

AT & T was planning to offer a day of cheap long-distance calling to make up for the software error. You can bet that AT & T's programmers are getting ready for a quality crackdown. Hmmm. Maybe UNIX isn't all it's cracked up to be.

No Thanks for the Memories

U.S. Memories, a cooperative venture made up of several of this country's top computer makers, has folded. The venture was started to pull Japanese DRAM manufacturer's fingers off U.S. computer maker's necks. The Japanese stranglehold on RAM chips occurred as U.S. manufacturers got out of the business. The price of DRAMs was going up and up, so creating U.S. Memories seemed like a good idea. But guess what? When U.S. Memories was on the scene, DRAM prices went back down. Now that U.S. Memories is gone, prices are headed back up. Seems like U.S. Memories was a good idea after all.

Coffee-Break Spies

How would you like to be spied on at work? If you were an Apple employee, you might be thinking about that right now. When one of Apple's never-ending stream of new-and-improved-and-more-expensive Macintoshes showed up in trade magazines before it was supposed to, Apple called in the FBI. Or rather, it called upon former FBI agents now on its staff. It worked. They plugged the leak. Should I feel old for remembering when Apple employees wore blue jeans and T-shirts and let everyone know what they were working on? Apple's wondering why it's not doing so well financially any more. Say, I can think of one reason. Put a spy on my back and see how productive I become.

The Usual Pleading

Well, that's the news for this month. If you find an interesting story about computers, clip it and send it to me. Be sure to include the name of the publication and the date. And be sure to include your own name as well. **G**

BASIC for beginners

Joysticks

Larry Cotton

Over the last several months, we've covered most of BASIC's lesser-known commands. Now let's put our knowledge to work as we examine the ubiquitous joystick.

Simpler joysticks are really only five switches and two actuators in a box. When you plug a joystick into your computer and push the stick or press the fire button, you're just turning on switches. When you release the stick and button, all the switches turn off. Usually, more than one switch can be turned on at a time, such as the north and west (up and left) switches.

Reading the Sticks

To determine the direction in which a joystick is being pushed, we read the port into which the stick is plugged. Each port, on both the 64 and the 128, is represented by a single memory location—56321 for port 1 and 56320 for port 2.

You may have heard that the best way to read the joysticks is in machine language rather than in BASIC. Fastest, yes, but not necessarily the best. Usually, only the *results* of pressing the joystick need to be in machine language.

Let's not make this any more complicated than it needs to be. The 64 and 128 user manuals suggest using PEEK and AND when determining the position of the joysticks. But, for our purposes, we can get away with just PEEKing. To read port 1 (memory location 56321), enter

```
10 JS=56321
20 PRINT PEEK(JS):GOTO 20
```

Remember that we use PEEK to look at a particular memory location—perfect for reading the joystick ports. If you run this, you'll see a string of 255s on your screen. This tells you that none of the joystick switches are on or that the joystick isn't plugged in. If the latter is true, grab a joystick and plug it into port 1 (the port nearest you on the right side of the computer). Then move the stick about and press the fire button. As the program runs, observe the results.

You'll notice that a unique number appears as you move the stick in each direction. Press the fire button and you'll see another number. Did you also notice that when you pressed it west (to the left), you saw a string of 251s that printed much slower? I'll explain this phenomenon in a minute.

Now, plug your joystick into port 2 (next to the power-supply port). To read it, change line 10 to

```
10 JS=56320
```

Move the stick or press the fire button. You'll see another series of numbers. The accompanying table shows the directional numbers that are returned and also lists the keyboard equivalents. (The keyboard equivalents are rarely used, but they might come in handy if you don't want to take the time to plug in a joystick.)

The letters *N*, *E*, *S*, and *W* in this table represent up, right, down, and left, respectively. *Logo* refers to the key with the Commodore logo on it at the extreme lower left of the keyboard.

Notice that the table shows only the basic directions the stick can be moved and the fire button can be pressed. The computer can also sense combinations, such as northwest (up and left) or southeast (down and right), plus it can distinguish when the fire button is being pressed either with the basic directions or with the combinations. I won't list all the possibilities here, but feel free to experiment.

The keyboard equivalents seem to be pretty random but are related to the way the keyboard is wired. That's why, when you press the joystick to the left, the string of numbers slows down, just as a BASIC program listing would if you pressed the CTRL key.

BASIC 7.0 (on the 128) includes special joystick functions. However, to keep this column as generic as possible, we won't discuss those here.

Here's a classic program—pretty much useless in a practical sense—which illustrates how to read port 1.

```
10 JS=56321:NP=255:N=254:E=247:
   S=253: W=251:F=239
20 K=PEEK(JS):IF K=NP THEN 20
30 IF K=N THEN PRINT"NORTH"
40 IF K=E THEN PRINT"EAST"
50 IF K=S THEN PRINT"SOUTH"
60 IF K=W THEN PRINT"WEST"
70 IF K=F THEN PRINT"FIRE"
80 GOTO 20
```

This program loops at line 20 until you move the stick or press the fire button. To read port 2, change line 10 to

```
10 JS=56320:NP=127:N=126:E=119:
   S=125:W=123:F=111
```

That's all there is to it!

Uses for Joysticks

What uses do the joysticks and their ports have? Actually, all sorts of things. One of the most common is to move sprites. (Sprites, as you probably know by now, are special programmer-definable shapes, such as aliens and rockets, which can be displayed anywhere on the screen, independent of text or any other graphics.) But there are many more uses, such as with pixel-by-pixel drawing on the high-resolution screen or for pointing within menus.

Personally, I don't like to mix joystick and keyboard commands. Having to put down the controller to press a key on the keyboard is inconvenient and time-consuming. The best way to use the stick is for everything—choosing items from a menu, shooting the aliens, drawing, dragging musical notes, or whatever.

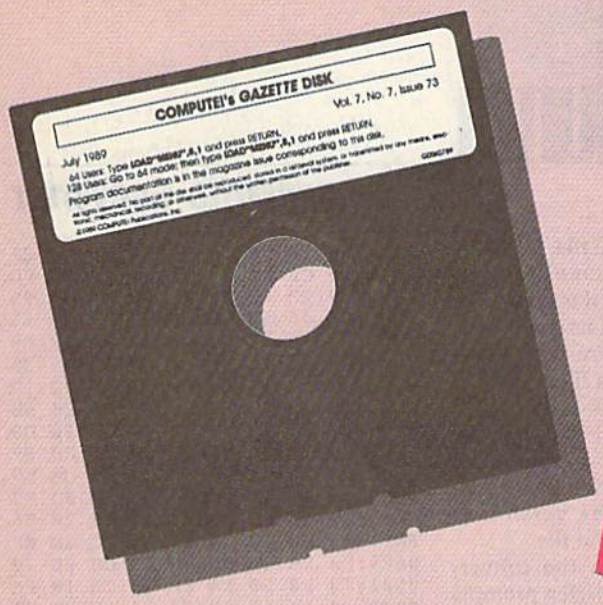
Here's how to increment or decrement numbers one at a time with a joystick plugged into port 2:

```
10 JS=56320:NP=127:N=126:E=119:
   S=125:W=123:F=111
```

continued on page 16 ▷

Joystick Directional Numbers and Keyboard Equivalents

Port 1 (56321)			Port 2 (56320)		
Direction	Number	Keyboard	Direction	Number	Keyboard
N	254	1	N	126	Logo and f3
E	247	2	E	119	Logo and H
S	253	Left arrow	S	125	Logo and S
W	251	CTRL	W	123	Logo and F
Fire	239	Space	Fire	111	Logo and K
No Press	255	None	None	127	None



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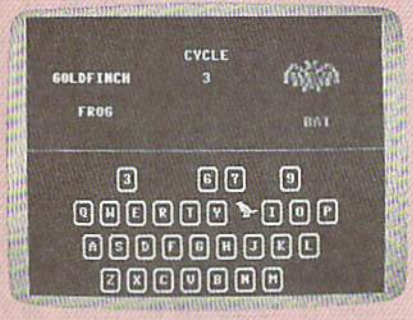

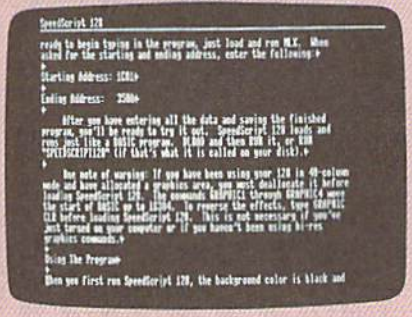

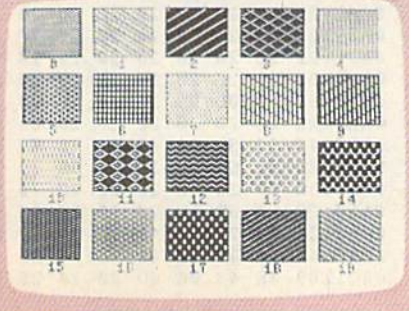

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THE geos column

geoWrite Converter

Robert Bixby

Convert your **geoWrite** *files to true ASCII, Commodore ASCII, or Commodore screen codes (***SpeedScript** *format) with this machine language utility program for the 64.*

All *geoWrite* documents are stored in Berkeley's Variable Length Indexed Record (VLIR) format. VLIR files differ from standard Commodore files in the way they're stored on disk. A directory entry for a standard Commodore file points to the beginning of the file data. In contrast, a directory entry for a VLIR file points to an index sector, which in turn contains pointers to different parts of the file.

Programs designed to load or copy standard Commodore files won't handle VLIR files correctly. If you attempt to copy a *geoWrite* file with a standard Commodore file copier, you'll get a copy of the index sector rather than the data itself. If you try to upload a *geoWrite* file to a bulletin board or to a communications service, you'll get similar results. Until someone designs a copy program or a terminal program that can handle VLIR files, you can use *geoWrite Converter* to convert *geoWrite* documents into standard Commodore format.

Typing It In

Since *geoWrite Converter* is written entirely in machine language, you'll need to use *MLX*, the machine language entry program located elsewhere in this issue, to enter it. The *MLX* prompts, and the values you should enter, are as follows:

Starting address: 0801
Ending address: 13E8

After you've entered the data, be sure to save a copy of the program to disk before leaving *MLX*.

Although *geoWrite Converter* is written in machine language, it loads and runs as if it were a BASIC program. To convert a file, simply load the program and type RUN. Then decide what format to convert the *geoWrite* file to: PETASCII (Commodore ASCII), *SpeedScript* (Commodore screen codes), or true ASCII. Press P to convert to PETASCII, S for *SpeedScript* format, or A for true ASCII.

Next, select the version of *geoWrite* used to create the original file. If the file was created with a version of *geoWrite* prior to 2.0, press 1; if it was generated with version 2.0 or one of its successors, press 2. If you're not sure which *geoWrite* was used to create a file, enter the GEOS environment, click the *geoWrite* file's icon, and then select info from the file menu. You should see an information dialog box which contains, among other things, the version of *geoWrite* used to create the file.

Once you've chosen the conversion type, *geoWrite Converter* prompts you for a directory search mask. The mask can be a filename, Commodore wildcard characters (see your disk drive manual for more information), or a combination of the two. Place the disk containing your *geoWrite* files in the disk drive and then enter the search mask. To examine all the files on the disk, use the default search mask (*).

After the program loads the list of filenames, select the file to convert using the cursor keys. Press the cursor-down key to scroll forward through the list; press the cursor-up key to scroll backward. When you find the file to convert, press RETURN. If the file isn't on the disk, insert another disk and press the back-arrow key (←) to load a new disk directory.

Once you've selected a file, *geoWrite Converter* reads it into memory, converts it into the requested format, and then prompts you for the name of the destination file. Put the disk that will contain the converted file into the disk drive and then type the filename. After *geoWrite Converter* saves a file to disk, it asks whether you'd like to do another conversion. If so, press Y; otherwise, press N to exit to BASIC.

geoWrite Converter

```
0801:0B 08 FF FF 9E 32 32 38 F2
0809:38 00 EE 08 FF FF 8F 22 D4
0811:0D 0D 0D 0D 0D 0D 0D 0D 21
0819:0D 0D 0D 0D 0D 0D 0D 0D 29
0821:0D 0D 0D 0D 0D 0D 0D 0D 31
0829:20 20 20 20 20 20 20 20 39
0831:20 20 20 20 B0 C0 C0 C0 2A
0839:C0 C0 C0 C0 C0 C0 C0 C0 49
0841:C0 C0 C0 AE 0D 20 20 20 2E
0849:20 20 20 20 20 B0 C0 C0 7D
0851:C0 BD 43 4F 50 59 52 49 64
0859:47 48 54 20 31 39 39 30 BC
0861:AD C0 C0 C0 AE 0D 20 20 A6
0869:20 20 20 20 20 20 DD 43 18
0871:4F 4D 50 55 54 45 21 20 F5
0879:20 50 55 42 4C 49 43 41 CB
0881:54 49 4F 4E 53 DD 0D 20 29
0889:20 20 20 20 20 20 20 AD 27
0891:C0 C0 AE 33 32 34 20 20 FD
0899:57 2E 20 57 45 4E 44 4F 95
08A1:56 45 52 B0 C0 C0 BD 0D 15
08A9:20 20 20 20 20 20 20 20 B9
08B1:20 20 20 AD AE 47 52 45 35
08B9:45 4E 53 42 4F 52 4F 2C 1D
08C1:20 4E 43 B0 BD 0D 20 20 6B
08C9:20 20 20 20 20 20 20 20 D9
08D1:20 20 AD C0 C0 C0 C0 C0 07
08D9:C0 C0 C0 C0 C0 C0 C0 C0 E9
08E1:C0 BD 0D 0D 0D 0D 0D 0D F7
08E9:0D 0D 0D 0D 00 00 00 20 56
08F1:18 09 20 4A 0D AD CC 0E BF
08F9:F0 F8 20 CD 0E AD CC 0E 70
0901:F0 F0 20 A8 0F 20 CD 10 FA
0909:20 6D 12 20 00 13 B0 FB 74
0911:C9 19 F0 DB 4C E2 FC A9 BB
0919:00 8D 20 D0 8D 21 D0 A2 D4
0921:02 20 CB 0C 20 08 0D A2 54
0929:00 20 CB 0C 20 EB 0C C9 10
0931:0A F0 0C C9 29 F0 0C C9 91
0939:0D D0 EC A9 02 D0 06 A9 47
0941:00 F0 02 A9 01 8D F2 0C 9A
0949:A2 01 20 CB 0C 20 EB 0C 72
0951:C9 38 F0 08 C9 3B D0 F0 C2
0959:A9 02 D0 02 A9 01 8D F3 5B
0961:0C 60 91 91 9B 63 4F 4E 34
0969:56 45 52 54 20 54 4F 20 98
0971:12 70 92 65 74 61 73 63 C4
0979:69 69 2C 20 12 73 92 50 F5
0981:45 45 44 73 43 52 49 50 8D
0989:54 2C 0D 4F 52 20 74 52 B5
0991:55 45 20 12 61 92 73 63 64
0999:69 69 20 3C 70 2F 73 2F D8
09A1:61 3E 3F 0D 00 00 00 0D B9
09A9:0D 69 53 20 54 48 45 20 77
09B1:47 45 4F 77 52 49 54 45 BF
09B9:20 46 49 4C 45 0D 56 45 AB
09C1:52 53 49 4F 4E 20 12 31 38
09C9:92 2E 33 20 4F 52 20 56 73
09D1:45 52 53 49 4F 4E 20 12 20
09D9:32 92 2E 30 0D 4F 52 20 DC
09E1:4C 41 54 45 52 20 3C 31 06
09E9:2F 32 3E 3F 0D 91 91 91 3F
09F1:91 91 00 00 00 00 00 00 31
09F9:00 00 00 00 00 00 00 93 9F
0A01:0E 08 0D 0D 12 9A 20 20 EB
0A09:20 20 20 20 20 20 20 20 1D
0A11:20 20 20 20 20 20 20 20 25
0A19:20 20 20 20 20 20 20 20 2D
0A21:20 20 20 20 20 20 20 20 35
0A29:20 20 20 20 20 20 20 20 3D
0A31:20 20 20 20 20 20 20 20 45
0A39:20 92 67 45 4F 57 52 49 09
0A41:54 45 20 63 4F 4E 56 45 B0
0A49:52 54 45 52 12 20 20 20 DA
0A51:20 20 20 20 20 20 20 20 65
0A59:20 20 20 20 20 20 20 20 6D
0A61:20 20 20 20 20 20 20 20 75
0A69:20 20 20 20 20 20 20 20 7D
0A71:20 20 20 20 20 20 20 20 85
0A79:20 20 20 20 20 20 20 20 8D
0A81:92 0D 0D 99 20 20 20 20 3F
0A89:20 20 20 20 20 20 20 63 E0
0A91:4F 50 59 52 49 47 48 54 FD
0A99:20 28 63 29 20 31 39 39 38
0AA1:30 0D 20 20 20 20 20 20 F8
0AA9:20 63 6F 6D 70 75 74 65 13
0AB1:21 20 70 55 42 4C 49 43 DA
0AB9:41 54 49 4F 4E 53 2C 20 D9
0AC1:69 4E 43 2E 0D 20 20 20 B2
```

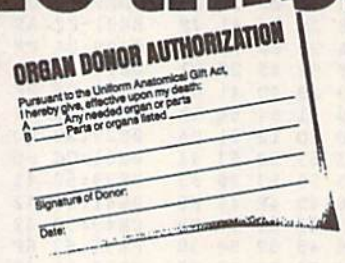
```
0AC9:20 20 20 20 20 20 20 20 DD
0AD1:61 4C 4C 20 72 49 47 48 C4
0AD9:54 53 20 72 45 53 45 52 6C
0AE1:56 45 44 0D 0D 0D 0D 0D 8F
0AE9:0D 0D 00 00 00 00 00 00 C7
0AF1:00 00 00 00 00 00 00 00 06
0AF9:00 00 00 00 00 00 00 00 0E
0B01:00 00 00 9B 0D 0D 0D 0D 94
0B09:0D 0D 00 00 00 00 00 00 E8
0B11:00 00 00 40 40 40 40 40 EE
0B19:40 40 40 40 40 40 40 40 2F
0B21:40 40 40 40 40 40 40 40 37
0B29:40 40 40 40 40 40 40 40 3F
0B31:40 40 40 40 40 40 40 40 47
0B39:40 40 40 40 40 40 40 40 4F
0B41:00 00 00 00 00 93 9B 65 42
0B49:4E 54 45 52 20 44 49 52 60
0B51:45 43 54 4F 52 59 20 53 E5
0B59:45 41 52 43 48 20 4D 41 7F
0B61:53 4B 3A 0D 2A 9D 00 93 67
0B69:6E 4F 20 4D 4F 52 45 20 D1
0B71:46 49 4C 45 53 20 4D 41 D1
0B79:54 43 48 20 50 41 54 54 1A
0B81:45 52 4E 00 0D 0D 12 81 DA
0B89:75 53 45 20 43 55 52 53 41
0B91:4F 52 20 4B 45 59 53 20 F2
0B99:20 54 4F 20 46 49 4E 44 F8
0BA1:20 46 49 4C 45 20 54 4F E9
0BA9:20 43 4F 4E 56 45 52 54 30
0BB1:20 20 41 4E 44 20 50 52 82
0BB9:45 53 53 20 72 45 54 55 5A
0BC1:52 4E 20 20 54 4F 20 53 0E
0BC9:45 4C 45 43 54 20 54 48 86
0BD1:45 20 46 49 4C 45 20 20 C7
0BD9:20 50 52 45 53 53 20 5F 3A
0BE1:20 20 46 4F 52 20 41 4E B1
0BE9:4F 54 48 45 52 20 44 49 FE
0BF1:52 45 43 54 4F 52 59 20 C6
0BF9:4C 49 53 54 49 4E 47 20 6A
0C01:92 9B 00 13 54 52 41 43 2C
0C09:4B 20 00 20 20 20 53 45 3E
0C11:43 54 4F 52 20 00 20 20 50
0C19:20 42 59 54 45 20 00 20 0D
0C21:00 93 9B 65 4E 54 45 52 88
0C29:20 46 49 4C 45 4E 41 4D 04
0C31:45 20 46 4F 52 20 4E 45 A6
0C39:57 20 46 49 4C 45 3A 0D 5B
0C41:00 93 9B 63 4F 4E 56 45 8D
0C49:52 54 20 41 4E 4F 54 48 58
0C51:45 52 20 3C 59 2F 4E 3E CA
0C59:3F 0D 00 93 9B 6C 4F 41 FB
0C61:44 49 4E 47 20 46 49 4C 25
0C69:45 20 49 4E 54 4F 20 4D A7
0C71:45 4D 4F 52 59 2E 2E 2E 9C
0C79:0D 00 93 9B 63 4F 4E 56 8F
0C81:45 52 54 49 4E 47 20 46 06
0C89:49 4C 45 2E 2E 2E 0D 00 29
0C91:93 9B 73 41 56 49 4E 47 98
0C99:20 46 49 4C 45 20 54 4F E3
0CA1:20 44 49 53 4B 2E 2E 2E D6
0CA9:0D 00 63 A8 00 46 68 85 AE
0CB1:04 04 0C 17 20 22 42 5C 2A
0CB9:7B 91 09 09 0A 0B 0B 0B 43
0CC1:10 0C 0C 0C 0C 0C 0C 0C DB
0CC9:0C 0C BD AB 0C 8D DA 0C B5
0CD1:BD BB 0C 8D DB 0C A0 00 62
0CD9:B9 00 00 F0 0C 20 D2 FF 64
0CE1:C8 D0 F5 EE DB 0C 4C D9 C1
0CE9:0C 60 A5 C5 C9 40 F0 FA 5D
0CF1:60 00 00 A2 00 A0 80 CA B2
0CF9:D0 FD 88 D0 FA 60 20 F4 A6
0D01:0C 20 F4 0C 4C F4 0C 20 F6
0D09:FF 0C 20 FF 0C 4C FF 0C C7
0D11:00 00 00 24 3A 20 20 20 20
0D19:20 20 20 20 20 20 20 20 33
0D21:20 20 20 20 20 20 20 20 3B
0D29:20 20 20 20 20 20 20 20 43
0D31:20 20 20 20 20 00 8D 12 97
0D39:0D A9 00 8D 11 0D 60 EE 89
0D41:11 0D AD 11 0D CD 12 0D BE
0D49:60 20 FD 0D A9 00 8D CC 61
0D51:0E A2 03 20 CB 0C A0 00 4D
0D59:85 C6 20 CF FF C9 0D F0 1B
0D61:09 99 16 0D C8 C0 10 90 F3
0D69:F1 60 C8 C8 8C 13 0D A9 AE
0D71:08 AA A0 00 20 BA FF AD E7
0D79:13 0D A2 14 A0 0D 20 BD 2D
0D81:FF 20 C0 FF A2 08 20 C6 F7
0D89:FF A9 06 20 37 0D 20 E4 E3
0D91:FF 20 40 0D 90 F8 A9 03 4B
0D99:20 37 0D 20 E8 0D 20 E4 D5
0DA1:FF C9 22 D0 F6 20 40 0D 45
0DA9:90 F1 A0 00 8C 36 0D 20 14
0DB1:E8 0D 20 E4 FF C9 22 F0 32
0DB9:0D AC 36 0D 99 26 0D C8 65
0DC1:8C 36 0D 4C B0 0D 20 E4 F4
0DC9:FF D0 FB A9 05 20 37 0D 56
0DD1:20 E4 FF 20 40 0D D0 F8 08
0DD9:20 98 0E 4C 9C 0D A9 08 25
0DE1:20 C3 FF 20 0E 0E 60 20 88
0DE9:B7 FF 29 40 F0 0D 68 68 FD
0DF1:A2 04 20 CB 0C 20 08 0D 1D
0DF9:4C DF 0D 60 A9 00 20 BD 25
0E01:FF A9 0F A2 08 A0 0F 20 94
0E09:BA FF 4C C0 FF 20 CC FF 32
0E11:A9 93 20 D2 FF A2 0F 20 E0
0E19:C6 FF 20 E4 FF C9 0D F0 1D
0E21:06 20 D2 FF 4C 1B 0E 20 AD
0E29:08 0D A9 0F 20 C3 FF 20 E2
0E31:CC FF 60 00 70 52 4F 47 72
0E39:52 41 4D 20 42 59 20 72 A4
0E41:4F 42 45 52 54 20 62 49 94
0E49:58 42 59 20 43 2F 4F 20 E4
0E51:63 6F 6D 70 75 74 65 21 19
0E59:20 62 4F 4F 4B 53 33 32 3D
0E61:34 20 77 2E 20 77 45 4E 29
0E69:44 4F 56 45 52 67 52 45 B4
0E71:45 4E 53 42 4F 52 4F 2C E0
0E79:20 6E 2E 63 2E 20 32 37 CA
0E81:34 30 38 48 A5 01 29 FC CF
0E89:78 85 01 68 60 48 A5 01 5A
0E91:09 03 85 01 58 68 60 EA C3
0E99:A0 00 A9 00 AE CC 0E F0 F0
0EA1:0C 18 69 11 90 01 C8 CA EC
0EA9:F0 03 4C A2 0E 85 FB 98 C9
0EB1:18 69 80 85 FC A0 00 B9 C0
0EB9:26 0D 91 FB C8 CC 36 0D 11
0EC1:90 F5 98 A0 10 91 FB EE 6E
0EC9:CC 0E 60 00 EA A9 00 8D 67
0ED1:59 0F A0 00 A9 00 AE 59 76
0ED9:0F F0 09 18 69 11 90 01 0E
0EE1:C8 CA D0 F7 85 FB 98 18 14
0EE9:69 80 85 FC A0 10 B1 FB FF
0EF1:8D 5A 0F A9 93 20 D2 FF AA
0EF9:A9 9B 20 D2 FF A0 00 B1 37
0F01:FB 20 D2 FF C8 CC 5A 0F BC
0F09:90 F5 A2 05 20 CB 0C 20 F9
0F11:F4 0C 20 EB 0C C9 39 D0 3A
0F19:06 A9 00 8D CC 0E 60 C9 A6
0F21:01 D0 01 60 C9 07 F0 04 6A
0F29:C9 02 D0 E6 AD 8D 02 F0 CD
0F31:14 CE 59 0F AD 59 0F C9 E3
0F39:DC 90 97 AC CC 0E 88 8C E3
0F41:59 0F 4C D3 0E EE 59 0F 84
0F49:AD 59 0F CD CC 0E 90 82 95
0F51:A9 00 8D 59 0F 4C D3 0E EA
0F59:00 00 A9 0F A2 08 A0 0F 23
0F61:20 BA FF A9 0E A2 73 A0 5B
0F69:0F 20 BD FF 20 C0 FF 4C 1F
0F71:0E 0E 53 30 3A 43 4F 4E 53
0F79:56 45 52 54 46 49 4C 45 D8
0F81:2C 70 2C 77 30 3A 00 00 39
0F89:00 00 00 00 00 00 00 00 A7
0F91:00 00 00 00 00 00 00 00 AF
0F99:00 00 00 00 00 00 00 00 B7
0FA1:00 00 2C 75 2C 72 00 20 E7
0FA9:FD 0D A0 00 A2 00 B1 FB 92
0FB1:99 87 0F C8 CC 5A 0F 90 6B
0FB9:F5 BD A3 0F 99 87 0F C8 79
0FC1:E8 E0 04 90 F4 98 8D A7 E2
0FC9:0F A9 08 AA A8 20 BA FF C0
0FD1:AD A7 0F A2 87 A0 0F 20 B9
0FD9:BD FF 20 C0 FF A2 08 20 A1
0FE1:C6 FF A0 00 8C 02 10 20 24
0FE9:E4 FF AC 02 10 99 34 03 82
0FF1:C8 8C 02 10 C0 80 90 EF F1
0FF9:A9 08 20 C3 FF 20 0E 0E D9
1001:60 00 00 55 31 2C 38 2C 7D
1009:30 2C 33 32 2C 31 39 0D 7B
1011:00 00 00 23 30 30 30 30 36
1019:30 30 30 30 30 30 31 31 3C
1021:31 31 31 31 31 31 31 31 41
1029:32 32 32 32 32 32 32 32 49
1031:32 32 33 33 33 33 33 33 90
1039:33 33 33 33 34 34 34 34 68
1041:34 34 34 34 34 34 35 35 64
1049:35 35 35 35 35 35 35 35 69
1051:36 36 36 36 36 36 36 36 71
1059:36 36 37 37 37 37 37 37 B8
1061:37 37 37 37 38 38 38 38 90
1069:38 38 38 38 38 38 30 31 72
1071:32 33 34 35 36 37 38 39 89
1079:30 31 32 33 34 35 36 37 91
1081:38 39 30 31 32 33 34 35 21
1089:36 37 38 39 30 31 32 33 0B
1091:34 35 36 37 38 39 30 31 8B
1099:32 33 34 35 36 37 38 39 B1
10A1:30 31 32 33 34 35 36 37 B9
10A9:38 39 30 31 32 33 34 35 49
10B1:36 37 38 39 30 31 32 33 33
10B9:34 35 36 37 38 39 30 31 B3
10C1:32 33 34 35 36 37 38 39 D9
10C9:00 00 18 1F A2 0D 20 CB 34
10D1:0C 20 08 0D 20 FD 0D AD 92
10D9:F3 0C C9 01 F0 05 A9 78 A7
10E1:4C E6 10 A9 7E 8D CD 13 57
10E9:A9 08 A2 08 A0 08 20 BA D5
10F1:FF A9 01 A2 14 A0 10 20 2A
10F9:BD FF 20 C0 FF A2 08 20 C3
1101:C9 FF A9 E6 85 FB A9 13 2E
1109:85 FC A9 06 85 FE A9 08 46
1111:85 FD A0 00 8C 03 10 8C A6
1119:02 10 AC 02 10 C0 78 90 FA
1121:16 A5 FB 8D CE 13 A5 FC 1B
1129:8D CF 13 A9 08 20 C3 FF 4B
1131:20 CC FF 20 0E 0E 60 B9 BB
1139:34 03 8D 12 10 A8 B9 15 B4
1141:10 8D 0B 10 B9 6F 10 8D 6A
1149:0C 10 EE 02 10 AC 02 10 BA
1151:B9 34 03 A8 B9 15 10 8D 18
1159:0E 10 B9 6F 10 8D 0F 10 99
1161:EE 02 10 AD 12 10 F0 B2 BD
1169:AC F3 0C B9 CA 10 8D C9 77
1171:10 20 CC FF A2 0F 20 C9 98
1179:FF A0 00 B9 04 10 20 D2 D2
1181:FF C8 C9 0D D0 F5 20 CC 4B
1189:FF A2 0F 20 C6 FF 20 E4 93
1191:FF C9 0D D0 F9 20 CC FF BE
1199:A2 08 20 C6 FF 20 E4 FF C9
11A1:8D 12 10 A8 B9 15 10 8D 6B
11A9:0B 10 B9 6F 10 8D 0C 10 62
11B1:AD 12 10 D0 09 20 E4 FF D0
11B9:8D 6B 12 4C D7 11 20 E4 AC
11C1:FF 8D 13 10 A8 B9 15 10 11
11C9:8D 0E 10 B9 6F 10 8D 0F B9
11D1:10 A9 FF 8D 6B 12 A9 02 38
11D9:8D 6A 12 20 E4 FF AE C9 EF
11E1:10 F0 06 CE C9 10 4C 4D 6A
11E9:12 AE CC 13 F0 06 CE CC 95
11F1:13 4C 4D 12 C9 01 D0 08 77
11F9:A2 04 8E CC 13 4C EA 11 BD
1201:C9 10 D0 04 A2 05 D0 F2 26
1209:C9 17 F0 EC C9 11 D0 04 FC
1211:A2 1B D0 E6 C9 0D F0 08 42
1219:C9 20 90 30 C9 80 B0 2C 1D
1221:20 84 0E A0 00 91 FB 20 A0
1229:8E 0E 20 C9 12 91 FD E6 72
1231:FB A5 FB D0 0B E6 FC A5 DC
1239:FC C9 FD 90 03 4C 22 11 B5
1241:E6 FD A5 FD C9 F8 90 04 44
1249:A9 08 85 FD EE 6A 12 AD C7
1251:6A 12 F0 0A CD 6B 12 F0 1F
1259:02 B0 03 4C DC 11 AD 12 68
1261:10 F0 03 4C 72 11 4C 1B 7A
1269:11 00 00 00 A2 0E 20 CB 6F
1271:0C 20 08 0D AD F2 0C D0 97
1279:01 60 A9 E6 85 FB A9 13 5C
1281:85 FC AD F2 0C C9 01 D0 E6
1289:2C 20 84 0E A0 00 B1 FB A1
1291:20 8E 0E C9 41 90 0A C9 F1
1299:5B B0 06 18 69 80 4C B0 70
12A1:12 C9 61 90 0A C9 7B B0 95
12A9:06 38 E9 20 4C B0 12 20 87
12B1:DD 12 4C 8A 12 20 84 0E A3
12B9:A0 00 B1 FB 20 8E 0E 20 9B
```

The Geos Column

```
12C1:C9 12 20 DD 12 4C B6 12 72
12C9:C9 0D D0 04 A9 1F D0 0B E6
12D1:C9 61 90 07 C9 7B B0 03 56
12D9:38 E9 60 60 20 84 0E A0 76
12E1:00 91 FB 20 8E 0E E6 FB 62
12E9:A5 FB D0 02 E6 FC A5 FB 8C
12F1:CD CE 13 90 09 A5 FC CD C2
12F9:CF 13 90 02 68 68 60 20 C2
1301:FD 0D A2 0B 20 CB 0C A9 60
1309:00 8D D0 13 A2 00 85 C6 C4
1311:20 CF FF C9 0D F0 0A 9D B5
1319:D0 13 E8 E0 10 90 F1 38 76
1321:60 AD D0 13 D0 03 4C 1E 77
1329:13 C9 0D F0 F0 8E CB 13 68
1331:A2 0F 20 CB 0C 20 08 0D 2B
1339:AE CB 13 AC F2 0C B9 C4 D6
1341:13 8D C8 13 A0 00 B9 C7 DE
1349:13 9D D0 13 C8 E8 C0 04 1B
1351:90 F4 8A A2 D0 A0 13 20 C7
1359:BD FF A9 08 AA A8 20 BA 07
1361:FF 20 C0 FF A2 08 20 C9 E6
1369:FF AD F2 0C C9 02 F0 0B 5D
1371:A9 E6 85 FB A9 13 85 FC 38
1379:4C 84 13 A9 E4 85 FB A9 C2
1381:13 85 FC 20 84 0E A0 00 D1
1389:B1 FB 20 8E 0E 20 D2 FF 0B
1391:E6 FB A5 FB D0 02 E6 FC F7
1399:A5 FB CD CE 13 90 E4 A5 82
13A1:FC CD CF 13 90 DD A9 08 3C
13A9:20 C3 FF 20 0E 0E A2 0C CC
13B1:20 CB 0C 20 EB 0C C9 19 9A
13B9:F0 07 C9 27 F0 03 4C B4 A6
13C1:13 18 60 53 53 50 2C 00 EC
13C9:2C 57 00 00 00 00 00 00 DB
13D1:00 00 00 00 00 00 00 00 F7
13D9:00 00 00 00 00 00 00 00 FF
13E1:00 00 00 00 08 00 00 00 48
```

G

Before you do crack, do this.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Pursuant to the Uniform Anatomical Gift Act,
I hereby give, effective upon my death:
A _____ Any needed organ or parts
B _____ Parts or organs listed
Signature of Donor:
Date:

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Then no one can say you didn't do anything worthwhile with your life.

Partnership for a Drug-Free America, N.Y., NY 10017

BASIC for Beginners cont. from page 12

```
20 GOSUB 1000
30 PRINT "X="X"Y="Y
40 GOTO 20
1000 K=PEEK(JS):IF K=NP THEN 1000
1010 IF K=N THEN Y=Y+1
1020 IF K=E THEN X=X+1
1030 IF K=S THEN Y=Y-1
1040 IF K=W THEN X=X-1
1050 IF K=F THEN PRINT"FIRE!";
     :REM NOTE SPACE AND
     SEMICOLON
1060 RETURN
```

Line 30 would normally begin whatever action the program takes when the joystick is moved. Line 1050 would contain the consequences of pressing the fire button. This technique is useful when moving sprites or when drawing in high-resolution mode. The variables X and Y may be incremented or decremented by more than 1, of course, to achieve higher speeds.

Within Limits

Often, you'll encounter a programming situation in which X and Y may not exceed certain values. In such cases, you would change lines 1010–1040 as follows:

```
1010 IF K=N THEN Y=Y+1:IF Y>199
     THEN Y=199
1020 IF K=E THEN X=X+1:IF X>255
     THEN X=255
1030 IF K=S THEN Y=Y-1:IF Y<0
     THEN Y=0
1040 IF K=W THEN X=X-1:IF X<0
     THEN X=0
```

Substitute these lines in the previous program and run it. Then move the joystick and press the fire button. You should see values for X and Y change but never exceed the limits above. This technique could be used to ensure that illegal values won't get POKEd to memory locations or that a line which is being drawn won't go off the screen.

Miniature User Ports

One of my favorite uses for the joystick ports is as input-only user ports. (The actual, more elaborate user port is at the rear of the machine, to your left as you type, and can be used for both input and output.) You can buy a 9-pin plug at Radio Shack and connect wires to it; this effectively replaces the joystick plug.

Where can these wires lead? They could lead to a numeric keypad, to a counter that uses the guts from an old trackball, or to a relay that's triggered from a tape deck for synchronization of the computer to music. Of course, reading the joystick ports in these ways requires the necessary programming.

For instance, you usually want an event to occur only once when one of the switches is closed. In order to ensure that this happens, you'd need to use two subroutines such as those (at lines 100 and 200) in the short program which follows.

```
10 JS=56320:F=111:REM EQUIVALENT
   TO FIRE BUTTON PORT 2
20 GOSUB 100:PRINT "ON"
30 GOSUB 200:PRINT "OFF"
40 GOTO 20
100 K=PEEK(JS):IF K<>F THEN 100
110 RETURN
200 K=PEEK(JS):IF K=F THEN 200
210 RETURN
```

Line 20 sends control to the subroutine at line 100, which looks at the joystick port for a value of 111 and only 111. This detects whether the fire button (or other switch or relay) is triggered. If it is, line 110 returns control to line 20 which prints the word ON. Line 30 immediately sends control to the subroutine at line 200, which continues to look at the port. If the switch is still on, the program loops at line 200 until it's off. When it is, control goes back to line 30, which prints OFF. Line 40 completes the loop.

Of course, if you're creating your own homemade music videos, you would want some appropriate graphics displayed on the screen instead of just printing ON and OFF. But that's for another column. G

THE programmer's page

Disk Drives

Randy Thompson

"The Programmer's Page" is interested in your programming tips and tricks. Send all submissions to The Programmer's Page, COMPUTE!'s Gazette, P.O. Box 5406, Greensboro, North Carolina 27403. We'll pay $25–$50 for each tip we publish.

Take control of your disk drive with these hot programming tips.

Write-Protected?

This short subroutine detects if a disk is write-protected (has its write-protect notch covered).

```
GA 2000 OPEN 15,DV,15:PRINT#15
        ,"M-R";CHR$(30);CHR$(0
        ):GET#15,A$:CLOSE 15
JQ 2010 IF ASC(A$+CHR$(1))=1 T
        HEN PRINT "DISK IS WRI
        TE PROTECTED":GOTO 203
        0
AD 2020 PRINT "DISK IS NOT WRI
        TE PROTECTED"
ES 2030 RETURN
```

To use the subroutine, simply set DV equal to the device number of the desired drive and execute a GOSUB 2000.

Stacy Olivas
Graham, WA

Disk Full

This program accepts a non-write-protected disk and sets the disk's block-free information equal to 0. Once this is done, no additional data may be written to the disk because the disk drive thinks that the disk is full.

To use the program, simply type it in (be careful not to make any mistakes), run it, insert a disk into the drive addressed as device 8, and then press a key. The program prints FINISHED when the operation has ended. As a precautionary measure, use this program only on copies of disks. That way, if something goes wrong, you'll still have your original to fall back on.

```
JE 100 DIM Q$(255)
GS 110 PRINT "{CLR}{GRN}{DOWN}
       ":POKE 53280,0:POKE 532
       81,0
JF 120 PRINT "INSERT DISK AND
       {SPACE}PRESS A KEY"
HE 130 POKE 198,0:WAIT 198,1
EQ 140 PRINT "WORKING"
HE 150 OPEN 15,8,15:OPEN 5,8,5
       ,"#":PRINT#15,"U1:5,"0,
       18,0
HM 160 FOR I=0 TO 255:GET#5,A$
       :Q$(I)=CHR$(ASC(A$+CHR$
       (0))):NEXT
KJ 170 CLOSE 5
PG 180 FOR I=4 TO 71:Q$(I)=CHR
       $(0):NEXT:FOR I=76 TO 1
       43:Q$(I)=CHR$(0):NEXT
AF 190 OPEN 2,8,2,"#"
QK 200 FOR I=2 TO 255:PRINT#15
       ,"B-P:"2,I:PRINT#2,Q$(I
       );:NEXT
QJ 210 PRINT#15,"U2:2"0,18,0
XK 220 CLOSE 2
MP 230 PRINT#15,"I":CLOSE 15
XR 240 PRINT "{UP}FINISHED"
```

You can use this program to protect important disks from being written to. It will also fool people into thinking that your disk is completely full, even though it's not.

Danny F. Hummel
Essex, IA

Disk Change

Here's a short routine that waits until a disk has been inserted or removed from the disk drive. You must set the variable DV equal to the device number of the drive which you wish to check and then execute a GOSUB 3000.

```
GA 3000 OPEN 15,DV,15
HB 3010 PRINT#15,"M-R";CHR$(30
        );CHR$(0)
SM 3020 GET#15,W$
RJ 3030 IF ASC(W$+CHR$(0)) THE
        N 3010
KF 3040 CLOSE 15
RS 3050 RETURN
```

One example use of this subroutine might be in a single-drive copy program. Instead of waiting for the user to hit a key when it's time to swap disks, you could instruct him or her to remove the source disk and insert the destination disk; then have your program call the Disk Change subroutine twice, once to wait for the source disk to be removed and once to wait for the destination disk to be inserted. The user would never have to touch the keyboard.

Francisco Félix
La Paz, Mexico

1571 Info

About a month ago I received a letter from Kent Sullivan, General Partner of Dr. Evil Laboratories. He noted some incomplete and inaccurate information given in the July 1989 "Programmer's Page" regarding the 1571 disk drive and its ROMs. In his discussions with Commodore engineer Fred Bowen, Mr. Sullivan discovered some interesting facts. I've summarized some of the more salient pieces of information below.

First, there were five versions of the 1571 ROM made up, but only two versions were released to the public, the original production-version ROM (part number 310654-03) and the upgrade ROM (part number 310654-05). The last two digits in the chip's part number specify which version of ROM it is. You may be able to find some 1571 drives with -01, -02, or -04 ROMs since, according to Fred Bowen, "the rest likely did get distributed to beta test sites, which are notorious for distributing that which they are forbidden to." Here at COMPUTE!, for example, we have at least two 1571 drives that contain -01 ROMs.

The 1571CR that's found inside the 128D uses different ROMs than the stand-alone 1571. (The *CR*, by the way, stands for *Cost Reduced*.) There are two ROMs available for this drive: part number 318047-01 and part number 252372-01. These two ROM chips are exactly the same codewise; it's just that one is an EPROM (Erasable Programmable Read Only Memory) chip while the other is strictly a ROM chip.

As for bugs, Fred Bowen states, "The CR ROM came after the -05 ROM, and so it naturally inherited all of the fixes. Unfortunately, Dave Siracusa (the programmer) missed at least one, which I discovered some time later. The missing patch is called PATCH69, which deals with setting the BAM pointers when a double-sided disk is in use."

To see what could be done about PATCH69, I made a quick call to Commodore and found that there are no ROM upgrades available for the 1571CR. Then, on Mr. Sullivan's recommendation, I talked to Mark Fellows, the creator of JiffyDOS. Mr. Fellows has made extensive comparisons between the -05 and CR ROMs and says that the CR ROMs are missing not one, but *three* patches, and that his JiffyDOS 1571CR ROM replacement contains all of the latest bug fixes. If you're interested, JiffyDOS 1571CR ROM is available from Creative Micro Designs (50 Industrial Drive, P.O. Box 646, East Longmeadow, Massachusetts 01028) for $29.95 plus $4.25 shipping. **G**

machine language programming

A File Lister

Jim Butterfield

Amigas, IBM clones, and UNIX systems use a program with the curious name of *More*. Perhaps its name should have been *Pagelist*, as it lists text files to the screen, stopping at the end of each page and asking *More?*. The user simply taps a key to see the next screenful of data.

Accompanying this column is an elementary version of *More* for the Commodore 64 and 128 that allows you to view files saved in Commodore ASCII format. The BASIC portion of this program POKEs the machine language (ML) routine into memory at $2000 (8192). It then asks for the name of a file, opens this file as logical file 1, and then calls the ML routine.

We begin this routine by setting the status byte (BASIC reserved variable ST) at address $90 to 0. As the file is read in, ST has the value 0. When the file ends or when an error is encountered, ST becomes a nonzero value.

```
2000  LDA  #$00
2002  STA  $90   ;initialize ST byte
```

Next, we switch the input stream from the keyboard to logical file 1 using the Kernal routine CHKIN at $FFC6. The input stream remains switched for most of the program. Once the message <MORE> is displayed, the program will restore the input stream to the keyboard and wait for a keypress. When one is detected, the program will return here to reassign the input stream to the file.

```
2004  LDX  #$01  ;logical file 1
2006  JSR  $FFC6;switch input stream
```

After printing 22 lines of text from the file, the program pauses and prints <MORE>. Location $2301 holds our line count. Initially, we set this register to 0.

```
2009  LDA  #$00  ;zero line count
200B  STA  $2301
```

We count the number of characters on each line and store this value in $2302, also initialized to 0.

```
200E  LDA  #$00  ;zero character count
2010  STA  $2302
```

The instruction at address $2017 fetches a character of data from the file using the Kernal routine GETIN at $FFE4. Before this occurs though, we check the file status byte. If ST is a nonzero value, we quit reading the file and branch ahead to address $2070, where the program is wrapped up.

```
2013  LDA  $90    ;check ST byte
2015  BNE  $2070  ;end-of-file
2017  JSR  $FFE4  ;get character from file
```

By calling GETIN, we obtain a character in the accumulator. If this character isn't the RETURN character (decimal 13), we skip the special code that follows and branch directly to $2054.

```
201A  CMP  #$0D  ;RETURN?
201C  BNE  $2054
```

Assuming the character is a RETURN, we print it and add 1 to the line count. Next, we check to see if it exceeds 22 ($16). If the line count has not reached that full-screen value yet, we loop to address $200E, resetting the character count to 0.

```
201E  JSR  $FFD2;print RETURN
2021  INC  $2301  ;increment line count
2024  LDA  $2301  ;check for end of page
2027  CMP  #$16   ;22 lines?
2029  BCC  $200E  ;not yet
```

At this point, we have a full screen of data and pause with the message <MORE>. This message is stored at address $2074; we use an index loop to read and print it.

```
202B  LDY  #$00    ;print <MORE>
202D  LDA  $2074,Y
2030  JSR  $FFD2
2033  INY
2034  CPY  #$06
2036  BNE  $202D
```

Next, we disconnect from the file using the Kernal routine CLRCHN and return our input stream to the keyboard. Then we wait in a loop for a keypress.

```
2038  JSR  $FFCC  ;restore keyboard
                  input
203B  JSR  $FFE4  ;get a character
203E  CMP  #$00
2040  BEQ  $203B
```

If the keypress is the Q key ($51), a quit is requested, so we branch to the exit point.

```
2042  CMP  #$51  ;is it Q?
2044  BEQ  $2073
```

If a key other than Q has been pressed, we resume listing the file. But first, we erase the <MORE> message by printing the delete character (character 20, or $14) six times.

```
2046  LDY  #$00  ;erase <MORE>
2048  LDA  #$14
204A  JSR  $FFD2
204D  INY
204E  CPY  #$06
2050  BNE  $204A
```

After erasing <MORE>, we return to address $2004, where we reconnect the file input stream and zero all counters.

```
2052  BEQ  $2004
```

At address $2054, we've received a character other than a RETURN. Certain characters in the range $00–$1F and $80–$9F are not printable—they might change text color or perhaps clear the screen. First, we save the original character in the Y register and then strip the high bit from the copy of the character that remains in the accumulator. Hex values in the range $80–$9F will change to $00–1F, and our test reduces to this: "Is the value less than hex 20?" If it is—that is, it's a nonprintable character—we substitute a dot character ($2E). Then, we restore the original character, saved in the Y register.

```
2054  TAY  ;save A
2055  AND  #$7F   ;strip high bit
2057  CMP  #$20   ;less than 32?
2059  BCS  $205D  ;no, so restore A
205B  LDY  #$2E   ;yes, substitute dot
205D  TYA
```

The character is ready to be printed. A design decision: What about long lines that would run past the right margin of the screen? You could either wrap them onto the next screen line or truncate them.

I've chosen to truncate any long lines. I do this by a simple test: If the character count of the line is too high, I don't print the character. Wrapping the line wouldn't be much harder; you would print an extra RETURN character and continue on the next screen line, remembering to increase the line count and to zero the character count.

Next, we place the character count in the Y register.

```
205E  LDY  $2302
```

Address $2300 contains the maximum character count for your machine, set by the BASIC program. Notice how

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Machine Language Programming

BASIC figures the number of characters that will fit on your particular screen line (see line 500), POKEing the result to decimal 8960 ($2300). We next check the character count, now in Y, against this value. If it's over the limit, we skip the portion of the code that prints the character.

```
2061  CPY  $2300 ;exceeded screen
               width?
2064  BCS  $206C ;yes, so skip printing
```

Here's where we print and count characters. Then, we return to read more from the file.

```
2066  INC  $2302 ;increase character
               count
2069  JSR  $FFD2;print character
206C  BNE  $2013 ;and continue line
206E  BEQ  $2013
```

As we exit, we restore the input stream to the keyboard, again using CHRCHN.

```
2070  JSR  $FFCC
2073  RTS
```

And lastly, our <MORE> message is stored at $2074.

```
2074  3C 4D 4F 52 45 3E ; <MORE>
207A  (end code)
```

More

```
RA 100 DATA 169,0,133,144,162,
       1,32,198,255,169,0,141,
       1,35
HG 110 DATA 169,0,141,2,35,165
       ,144,208,89,32,228,255
DS 120 DATA 201,13,208,54,32,2
       10,255,238,1,35,173,1,3
       5
XF 130 DATA 201,22,144,227,160
       ,0,185,116,32,32,210,25
       5
QM 140 DATA 200,192,6,208,245,
       32,204,255,32,228,255
SR 150 DATA 201,0,240,249,201,
       81,240,45,160,0,169,20
BH 160 DATA 32,210,255,200,192
       ,6,208,248,240,176,168,
       41,127
DH 170 DATA 201,32,176,2,160,4
       6,152,172,2,35,204,0
AS 180 DATA 35,176,6,238,2,35,
       32,210,255,208,165,240,
       163,32,204,255,96
EC 190 DATA 60,77,79,82,69,62
BR 200 FOR J=8192 TO 8313
EJ 210 READ X:T=T+X
BP 220 POKE J,X
AE 230 NEXT J

BX 240 IF T<>15477 THEN PRINT
       {SPACE}"ERROR IN DATA S
       TATEMENT.":STOP
RP 500 PRINT CHR$(14):PRINT CH
       R$(157);:L0=POS(0):PRIN
       T:POKE 8960,L0
KM 510 INPUT "NAME OF FILE";F$
RM 520 OPEN 15,8,15
MK 530 OPEN 1,8,3,F$
AJ 540 INPUT#15,E,E$,E1,E2:IF
       {SPACE}E<>0 THEN PRINT
       {SPACE}E$;E1;E2:STOP
MF 550 SYS 8192
ES 560 CLOSE 1
HB 570 CLOSE 15
```

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All Around the House

Keith Ferrell

Inside, outside, cellar to attic—64s and 128s are doing plenty of housework!

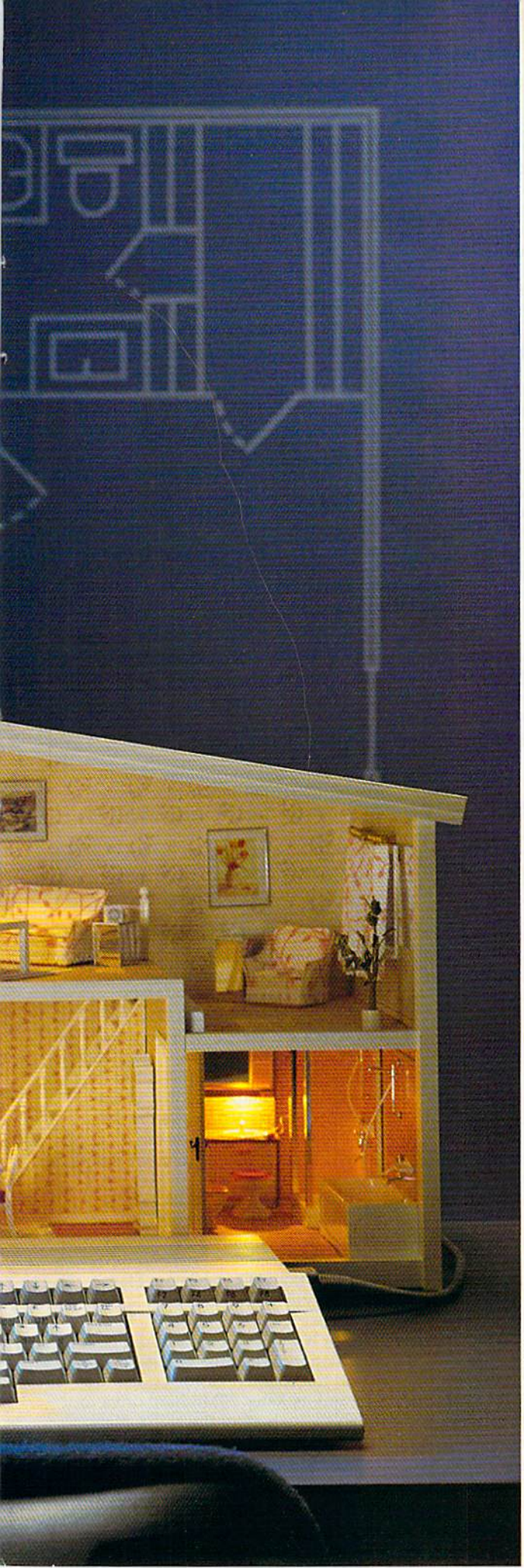


Photo ©1990 by Mark Wagoner

Home computer. That was the promise of the Commodore revolution, and it's a promise that's being kept every day by users throughout the world. And throughout the house. Here's a look at some of the ways our computers are being used in and around the home.

From the Ground Up

Thinking of building a home? Why not go whole hog and design it yourself, too?

Commodore 64 and 128 owners can take advantage of a couple of CAD (Computer-Aided Design) programs to do just that.

Home Designer, a program for the 128, was first published in 1987. Since then, hundreds of users have threaded their way through the intricacies of laying out floor plans, allowing space for water closets and windows, finding just the right spot for stairs.

"It's not just for designing houses," notes Joe Hubbard, president of Free Spirit, which acquired *Home Designer* when Hubbard purchased Briwall Software, the program's original publisher.

"People have written us about using *Home Designer* for everything from houses to mechanical drawings to model airplanes. The program can handle any kind of design work."

Hubbard has taken advantage of that versatility of purpose by publishing a disk-based library of electronic circuitry symbols which can be used by hobbyist and professional electricians. "It's been very popular," Hubbard says.

The $49.95 program continues to sell well. Hubbard feels that much of the credit for *Home Designer*'s ongoing success is owed to its own designer, Russ Kendall. "Russ works with mainframes," Hubbard says, "and he brings a little deeper understanding of computing to his programming. And it shows."

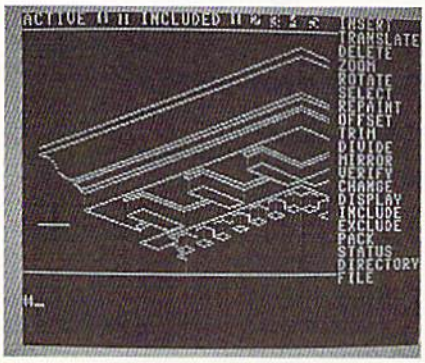
Abacus's $39.95 *Cadpak* brings CAD capability to the 64. (A 128-specific version is avail-

All Around the House

able for $59.95.) The programs can be used for any type of high-resolution graphic design, and they excel at producing accurately scaled printouts of the designs.

Scaling is, in fact, one of the most important aspects of CAD. Accuracy of scale ensures, for example, that your CAD-designed house and the property it stands upon are properly represented on the printout.

Cadpak accomplishes its scaling by building its drawings around base scale units that represent either inches



Free Spirit's *Home Designer* is used by hobbyists and professionals for designing everything from model airplanes to houses.

or centimeters. For printing, these units are in turn related to a formula that lets you reproduce, in precise scale, ambitious designs within the constraints of small printers.

Scaling is the aspect of *Cadpak* that Abacus is most proud of. "The output to printers in these programs is quite well done," says Jim Oldfield, the company's marketing director. "A great deal of effort was taken to make sure that the scaling out to printers is exacting and precise."

How accurate? How precise? Two-and-a-half years ago, our reviewer stacked up his *Cadpak*'s output against that of a professional surveyor with a more expensive computer. The proportions matched perfectly.

Lights Out! (Or On!)

Once the house is built, you have to take care of it. You can't always be home to do what needs to be done, but with a 64 or 128 and the right software and hardware add-ons, you don't have to be.

That, at least, is the philosophy behind the Home Control Interface produced by X-10 (USA) of Northvale, New Jersey.

Introduced in 1985, X-10's product puts control of appliances, lights, and heating/cooling systems in the electronic hands of your computer. The $69.95 Home Control Interface itself consists of X-10's software and a cable that connects to the computer's user port. To this basic setup are added various modules, which include lamp controllers with dimmers, 220-volt heavy-appliance modules, three-way wall-switch controllers, and others. A single 64 or 128 can control up to 95 different X-10 modules. The modules accept commands from the software, executing timed events at your discretion.

What sorts of events? Indoor and outdoor lights, stereos, and televisions can be switched on and off to give the illusion that someone's in the house when someone's not. (One ex-*Gazette* staffer swears by X-10's security potential: He won't leave home without programming his 64-based X-10 system!) The system can be programmed to turn on air conditioners or heaters as you leave work, ensuring the right temperature by the time you pull into the driveway.

X-10 technology is not just for humans. Among the company's customers are people who use the product to warm henhouses and grain elevators on a regular basis.

What's It Worth?

Buying or selling a house or piece of property? The bank, savings and loan institution, or financial service you use is going to want an independent appraisal.

If you live in or near Emporia, Kansas, that appraiser might be Steve Schaeffner, which means that the relevant numbers will be crunched through a Commodore 64.

Schaeffner got the computer from his father a few years ago and now would not do without it. At first, though, he wasn't sure just how much of a contribution the 64 would be able to make to his business.

Looking through appraisal-industry publications, Schaeffner saw plenty of business software—but none of it for his computer.

"There were any number of programs for IBM machines," Schaeffner says, "and they all cost hundreds of dollars."

Finally, though, he found an appraisal package for the 64. Even better, the software cost only $100. Better still, the package from The Rhombus Group *worked*.

"It's made all the difference in the world," Schaeffner says. "Now, as I inspect a property, I'm able to make as few field notes as possible. Once I'm back at the office, I incorporate those notes into the program."

Where Schaeffner once had to spend hours manually filling out an appraisal form, the drudge work is now handled by the 64. "It's terrific," he says. "When I make an adjustment in my calculations, the change is reflected throughout the program. I've taken a lot of little things and reduced them to a single keystroke, which saves a lot of time."

Like many businesses, fee appraisal includes a fair amount of repetitive work. After some time in the business, Schaeffner points out, you've seen just about every type of property. With hundreds of appraisals on file, Schaeffner has turned repetition into an advantage.

"I've set up templates that can handle just about every situation I run into," he says. "That saves at least 50 percent of my time." Other software tools in Schaeffner's appraisal arsenal include *SwiftCalc* and *Word Writer*.

When the appraisal is done, Schaeffner prints it out via a Star NX-1000C. The output is professional and crisp, more than presentable enough for his demanding financial clients.

Roll 'Em!

You've designed your home, bought or sold it, and put its security system on automatic. Time to relax with a rented video.

And if you're in Buenos Aires, the videos you rent are catalogued and your rental fee is tallied by a 128-based system.

Peter Northrup, who created custom software for Cinehogar, a Buenos Aires video-rental establishment, set up a system of four 128s, a 1750 RAM expander, and two 1571s, all linked to a ten-megabyte hard drive via a switching device. Four magnetic card readers are also connected to the system, which outputs to the screens of 1902 monitors or to paper by way of Citizen or Panasonic printers. There is room on the system for four more terminals.

Cinehogar's system can handle up to 5000 members and 6000 films, keeping track of rentals, returns, overdue films, special requests, and other aspects of the video business. Members' magnetic cards include a special parity code to ensure privacy.

Nor has the 64 been left out of the equation. While the 128 system is behind the counter, customers can use a 64 and its Xetec 20MB hard drive to search through all of the club's films. Aware of the general public's antipathy toward keyboards, Northrup set up a menu system that enables searching to be accomplished via a

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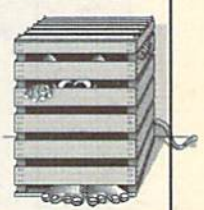

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SOLID PRODUCTS . . . SOLID SUPPORT

Ports to Ponder

Unattended computer control of lights, heating, or air conditioning on a day-to-day basis requires that the computer stay on continuously. In my neck of the woods, however, the power generated by our local utility is so sporadic that extended control is almost impossible.

To solve this problem, I confine my computer activities to shorter periods of time. I may not be seizing control of household appliances, but I've utilized just about every port (socket) in the computer to connect to some rather bizarre devices.

The Plodder

I like printing pictures from the high-resolution screen. Unfortunately, the results are not great—rather small black-and-white images. I decided to build a plotter that would enlarge my images and paint them at the same time, using all 16 colors. In the process of designing and building this project, I uncovered the classic way of connecting the computer to the outside world: through the user port, then through isolating circuitry, and finally, through relays (for low-voltage DC) or triacs (for 115-volts AC). The completed device would be called the Plodder, and the name is appropriate. Painting the entire 18 × 24 inch picture takes 36 hours—pushing the limit of my utility's capabilities.

If you're seriously interested in connecting your 64 or 128 with electrical devices and you're not an electronic wizard, get a copy of *Commodore Interfacing Blue Book*, published by Microsignal Press. Also get hold of any of the excellent beginning electronics books carried by Radio Shack.

MIDI

MIDI stands for *Musical Instrument Digital Interface.* It's *the* way to connect computers to the newest electronic keyboards, such as those made by Korg, Casio, and Yamaha. A circuit for a homebrew MIDI interface was published in the May 1986 issue of *Electronic Musician.*

I built it, dutifully entered the program, and connected the interface between the computer and my Korg DW 8000 synthesizer. Following the instructions to the letter (I thought) yielded absolutely nothing. Much agonizing revealed that the "expansion port" to which the article referred is actually the 64's *cartridge port*—not the user port. Once I replaced my fast-loading cartridge with the interface board, I was able to play the synthesizer—and later, a MIDI-able drum machine—using the computer and only a simple program written in BASIC.

By the way, since the keyboard's MIDI ports expect to communicate in computerlike signals, no special current-boosting circuitry, such as relays, is required.

Little Drummer Boys

Later I figured that the computer could play *real* drums. Starting in miniature, I built some small drums and cymbals, struck by solenoid-controlled sticks. Going back to the user port, I connected the solenoids to the computer through a relay interface. Not at all practical, but a lot of noisy fun.

In these cases, the computer is employed only as a very sophisticated, programmable eight-channel timer. Each of the eight user-port output lines can control one electrical signal. In BASIC, you simply POKE the port's memory locations with various values, interspersed with FOR-NEXT loops to control timing.

More sophisticated timing can be accomplished by taking advantage of the computer's built-in clock. A BASIC program using the TI$ variable (see next month's "BASIC for Beginners" column) provides a highly accurate means of controlling external events, whether they're drum beats, pen movements, or MIDI signals.

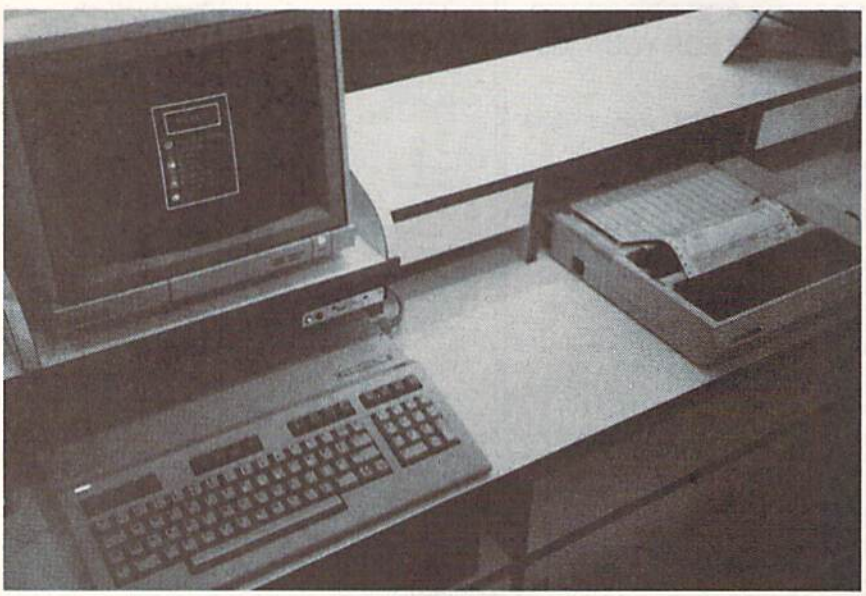
Other Computer Connections

The 64 and 128 can control a voice-generating chip, such as the one sold by Radio Shack. With it, your computer can verbally warn you of aliens approaching, or that you're about to format a valuable disk, or that water has just started pouring into your basement. All these suggest sensing environmental conditions, such as temperature, humidity level, rainfall, sound, light, or forces (a seismograph?).

Other worlds of creative computer interfacing revolve around the telephone or hobbies such as ham radio and model railroading. A modem plugged into the user port literally connects your computer to anyone else in the world with a computer and opens up new worlds of communication and creativity. There are also cartridges available which allow you to read ham radio transmissions on your computer monitor or TV screen.

Computer control of an HO-scale railroad could include programming the SID chip to produce most of the sounds associated with railroading, as well as controlling up to eight separate train and peripheral functions with the user port. Or the voice chip could announce "BOOAAARRDD!" and "Ticket, please." The possibilities stagger the imagination.

—Larry Cotton



Peter Northrup's custom system, driven by four 128s, lets a large Buenos Aires video-rental business manage thousands of customers and titles.

numeric keypad. The 64 is always working—when there's no customer online, it flashes top-10 titles and other promotional information.

"Whenever somebody says a 64 or 128 cannot be used for serious work," Northrup writes, "I send them to the club for a look.

"I think you'll find all of this interesting."

To say the least.

[Editor's Note: We were unable to locate The Rhombus Group, the California-based developer of the appraisal package used by Steve Schaeffner. If you have information about Rhombus, or any other 64/128-based custom business packages, please drop us a line.

Information about household, business, or other applications of 64s and 128s is always welcomed at Gazette. *Let us hear from you—we'd like to share your story with our readers.]* G

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FROM THE OTHER SIDE

Sysops Speak Out

Tom Netsel

Lots of 64 and 128 users dream of running their own bulletin boards. So what's it like? How much time is required? How great is the investment? We talked to six sysops to find out.

When you log off an electronic bulletin board system (BBS), there's usually a place to leave feedback or post comments to the system operator (sysop). This is where callers present compliments, air gripes, or offer suggestions for improving the system.

Recently, I called several boards around the country and asked the sysops for feedback and comments of their own. Since they are usually on the receiving end of the bouquets or brickbats, this article affords them a chance to post their own comments about the problems and rewards of running a BBS.

Peter Jones,
Sysop of the BFD BBS,
Greensboro, North Carolina

Lots of positives, very few negatives. There are a few problems but nothing too serious. With the verification procedure in place, almost everyone is pretty well behaved. Oh, I get the occasional user who tries to sign on without being verified, leaves false info, and so on, but as soon as the first bit of info fails to check out, that account is deleted.

My biggest peeve is the user who does nothing but build a personal software collection. That user will tie up the board for hours each day and give nothing in return. My answer has been to install an unofficial download-to-upload ratio of 15:1. The user gets a warning first, and if he continues, I just cut his download access. Users who are active in the message base are not restricted. They participate and do a lot to insure the success of this board.

I guess the stories I would like to share are the successes. I've met some nice people and some exceptional people. The board has introduced me to some people I call true friends. I have also learned more about computers in the 3½ months that my board has been up than I have in years of previous computer experience.

Steve Fink, Sysop of The Greater Omaha Commodore Users Group BBS and The Abyss South, Omaha, Nebraska

I am currently running two BBSs from my home: the club's on a 128 and my own personal system on an Amiga 500. Running a respectable BBS requires a lot of time and money. Patience can often become a commodity that runs short, but it's not just nice to have, it's required!

Why do I run a BBS? I think you'll find that a lot of sysops will tell you they're not really sure. I enjoy the feeling of accomplishment I get when I spend hours modifying my system and then watching the users' reactions to the changes. Most callers are appreciative, and they won't hesitate in telling you so.

I enjoy watching young and old alike communicating with one another. It's absolutely refreshing to see a 14-year-old having an intelligent conversation in the message area with a 50-year-old. Remember that most users don't know the age, race, or sometimes even sex of their fellow callers. A BBS is the best barrier buster I've ever seen. Too bad it can't be carried on offline.

I could spend hours in this room between these two systems and not realize the huge chunk of time that has passed until my wife comes in to say goodnight. Still, other times I've gone into the living room to see what's up, only to find a pillow and a blanket waiting for me on the couch.

One of the worst duties a sysop has to perform is voice validating, calling the number left by the user in order to confirm his or her identity. Although I don't like this chore and don't do it all the time, the sysop who doesn't do it is inviting trouble.

Years ago, when I first started running a BBS, I never called to voice-validate. One night while watching people do their thing on my BBS, I noticed a person log on who called himself the Midnight Hacker. At that time I allowed aliases on my board, so it didn't concern me too much until this person started entering odd characters at the menu prompts. I watched for a short time until I became tired of him messing around. I figured if he wasn't going to do anything productive, he could get off and let someone else on who would.

When I hit the *chat* key to speak with him, I instantly got a lost carrier—he hung up. This went on for several nights. Each time I hit the chat key, he would detect my presence and drop carrier. Finally, much to my surprise, on the fifth night he stayed online. I figured I didn't have much time to say what I wanted to tell him before he dropped carrier, so I instantly started telling him off. When I finished, I was even more surprised to see he was still online but not responding. I threw some more heavy language at him, but nothing happened.

Frustrated, I hit the *force log-off* key and watched as the BBS booted him off the system. He didn't return, not that night and not for several more. Feeling that I had won my first victory against a hacker, I started bragging to my good friend and cosysop about how I had talked this guy right off the telephone line.

My friend started laughing and said, "Ah, you weren't that bad. I've had other people talk to me worse than that before!" At the time I didn't think it was so funny, but now as I look back at it, it was sort of a funny prank he played on me.

Software pirates are another matter. To me, pirating is not swapping copyrighted software, but the act of breaking the copyprotection scheme so it can be copied and passed along easily. Having copyrighted material available for transferring on a BBS is not pirating, although boards that allow or encourage it are often known as pirate BBSs. It's simply a major violation of the copyright laws, and I do not condone this type of act. Most good sysops don't either. The ones who do are the exceptions.

Pirates who crack software are not the only ones to blame. Anyone who gets involved in the large-scale distribution of cracked software is also guilty, and that includes people who download it. Operating a BBS where everyone can download copyrighted commercial software is tantamount to a large commercial software swap meet. This type of stuff has literally driven software developers right out of business. And who pays the price for this lunacy? Everyone!

Like I said, I could rattle on and on about this stuff, but my wife just passed by the computer room with a pillow and blanket in her hands. Oh, well. . . .

Daryl Marietta, Sysop of The LowerBucks User Group BBS, Bristol, Pennsylvania

Why do I run a BBS? Well, I really can't say for sure. In some respects, it's a lot of fun, but there's also a lot of aggravation and work that goes along with it.

I've seen many people try to set up a system only to get discouraged because they didn't realize how much work goes into maintaining a busy BBS. If it doesn't get maintained, it degenerates fairly quickly and people stop using it. Not only that, but almost any type of BBS is a fairly sizable investment, and that probably restricts many people who might be running a system of their own.

I've found that if you screen your callers, you don't really get abuse from anyone. Unless it's from someone you've had to remove from the system. Most of the users are more than willing to work with you.

Maybe a good theory on why some sysops run BBSs is because they're telecommunications junkies. I know a number of other sysops I've talked to who would fit this description, as many are also into things such as ham radio, satellite communications, and networking.

Christine Parkison, Sysop of Da Crazies Inn BBS, Omaha, Nebraska

This BBS has been up and running for over four years now—which seems like forever. It's one of those stories that's probably typical. It started with the very basics in hardware—less than one meg, 300 baud, and all that. With time, the BBS has expanded, and it now has nine megs on a 128, with eight drives currently online and 1200 baud.

The BBS has over 350 users, and they seem to be very active. For every two callers, one piece of E-mail is sent to someone. I enjoy all the users, even the so-called hackers and phreakers. My BBS is pretty hackproof after years of experience and knowledge gained.

I started the BBS in an attempt to give all people freedom of speech via modem. We have some pretty controversial text files. There are no limits, so cursing is allowed, along with negative comments directed at anyone—including myself. I believe this is the only good way to run a BBS. Of course, this is my own opinion, but I have a lot of users who agree.

At first the BBS was a lot of toil and work. More hours than I could imagine went into programming it, fixing bugs, validating users, changing log-ons, updating text files, and all that. It also costs a pretty penny for equipment repair, the phone line, and disks, but it's worth it to me. ▷

Jim Ames,
Sysop of North Bay User Group BBS,
Vallejo, California

As vice president and librarian of the North Bay Users Group, I found that many of the club members had difficulty uploading and downloading programs and using their modems in general.

About a year ago, I decided to start a local BBS to teach the user group members how to use modems. The board is a club system, so the user group paid to have the phone line installed, and I donated the computer. Since then I've started my own private BBS.

You always get a few fools on there who like to tie up the system. I've had one or two people who have deliberately overloaded the message base with stupid messages just to see if they could make the board crash.

I am disabled and I run a deejay business from my home. Being home all day lets me keep a close eye on both boards and offer immediate feedback to any caller who experiences a problem. Unlike many sysops who must leave their boards unattended, I am usually around for help or a chat. I like to be of help whenever I can. That's what I enjoy about running a BBS. If I'm not around, most of my users know that they can leave me a note and I'll call them when I get home and help them work through their problem.

Lynne Miller,
Sysop of The Whale Zoo,
Greensboro, North Carolina

My BBS is for adults only. Everyone underage thinks this is some mysterious house of porn (it's not) and has tried every trick in the book to get an account on here. The most notable was a persistent young man who left a name and number and was very specific about what time to call for verification.

Due to a slight conflict in schedule, I had to call the given number about ten minutes earlier than specified. Someone, obviously an adult, answered to the name, but was totally confused as to what I was talking about. All of a sudden in the background, I heard the sounds of a young person breathlessly running into the room and yelling, "I'm expecting a phone call and I used your name and number. Let me explain it to you real quick because they're going to call any minute!"

Needless to say, the elaborate scheme failed miserably. And to think I almost bought an ant farm instead of a computer. G

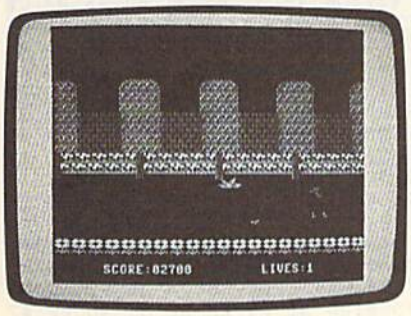
The BBS 10 Commandments

(Or 10 Ways Callers Can Keep a Sysop Happy)

1. **Honor your sysop—you can go nowhere on the BBS without his or her validation or blessing.**
2. **Do not upload or download copyrighted software.**
3. **Supply your true name and telephone number when registering. Use a handle or pseudonym only when permitted.**
4. **Do not request a chat with the sysop at 2:00 a.m. or any other time he or she is known to be sleeping.**
5. **Download software and enjoy it, but upload at least occasionally.**
6. **Do not hang up on a system. Use the proper log-off procedure when you're ready to disconnect.**
7. **Do not attempt to crash, abuse, or misuse a BBS. Remember, you're a guest on someone else's system.**
8. **Support your local BBS by leaving public messages for other callers and offering constructive criticism to the sysop.**
9. **Don't hog the system; observe its time limit and any downloading restrictions. After logging off, do not immediately call back using a bogus name.**
10. **Honor your neighbor. Do not sling abuse or insults at sysops and other callers unless it's done in jest, with the sysop's blessing, and on the proper subboard.**

Apple Willie

Hubert Cross



Mom always said, "An apple a day keeps the doctor away," but she never warned you about poisonous snakes and attack birds. Find out if you're up to the challenge in this charming game for the 64. Joystick required.

The apples are ripe and have fallen from the trees at Willie Applecore's orchard. You must help Willie pick up his crop in time for market. The inhabitants of the orchard—namely a large flock of Meanie Greenie attack birds and an army of poisonous Seedsucker snakes—have other plans. They're ravenously hungry and will do anything to keep you from collecting the harvest.

The odds are against you. But Willie, who also plays guard for the Washington Applepickers basketball team, possesses a tremendous vertical leap and is as quick in the orchard as he is on the court. He uses this deft athleticism to avoid his enemies in the orchard, while swiftly gathering nature's bounty.

Apple Willie is a fast-moving arcade-style game that requires quick reflexes. The object of the game is to pick up as many apples as possible while leaping over the snakes or dodging the birds. Each time you pick up an apple, you score points and save more of Willie's crop from these terrible pests.

Getting Started

Apple Willie consists of two programs—a BASIC loader, Apple.Boot, and a machine language file, APPLE.ML. To ensure accurate typing, enter Apple.Boot using *The Automatic Proofreader*, located elsewhere in this issue. Be sure to save a copy of the program to disk when you're done.

To enter the ML file, you'll need to use *MLX*, the machine language entry program also found elsewhere in this issue. When *MLX* prompts you, respond with the values given below.

Starting address: 7000
Ending address: 8147

After you've finished typing in this program, save a copy of it to disk as APPLE.ML.

When you're ready to play, plug your joystick into port 2; then load and run Apple.Boot. After loading APPLE .ML, the program creates 40 high-resolution animation frames and then waits for you to start the game.

Harvest Time

To begin the game, push the joystick in any direction. To start Willie on his way through the orchard, move the joystick to the left.

The Meanie Greenies and Seedsuckers will come at you from left to right. If you come into contact with either a bird or a snake, you'll lose one of your three lives.

To avoid a snake, press the fire button while moving the joystick to the left. This causes Willie to jump forward over the reptile. The birds approach you on two different levels, at your waist and at your head. To dodge the ones that fly at waist level, you must

jump, just as you jump over the snakes. To avoid the ones that fly at your head, you must duck. To do this, pull down on the joystick. This will also cause you to come to a complete stop.

To pick up an apple, simply walk over it. If you miss an apple as you're walking along, there's no way to go back and get it. So be sure to pick up as many apples as you can when you come upon them.

For each apple you successfully pick up, you're awarded 100 points. Your score as well as the number of lives remaining are displayed at the bottom of the screen.

The game ends when you lose all three of Willie's lives. To play again, move the joystick.

A Few Tips

The key to the game is to keep moving, timing your leaps and ducks to avoid the barrage of orchard attackers. If you stand still too long, a bird may catch up with a snake. You'll find it's virtually impossible for you to dodge both at once.

Two notes of warning: Don't press RUN/STOP while the program is setting up, and don't press RESTORE at any time during the game. Doing either will likely cause the computer to lock up.

Apple.Boot

```
FF 1000 IFA=0THENA=1:LOAD"APPL
        E.ML",8,1
QB 1010 B=28672:C=B+3:D=C+3:E=
        D+3:G=E+3
JF 1020 H=G+3:J=H+6
FC 1030 PRINT"{CLR}CREATING 40
         SCENERY FRAMES"
BF 1040 PRINT"{DOWN}* PLEASE W
        AIT ONE MINUTE *"
XA 1050 FORDE=1TO2000:NEXT:SYS
        B:SYSC
EJ 1060 POKE53265,59:POKE53270
        ,216
AJ 1070 POKE53272,128:POKE5657
        6,150
JR 1080 PRINT"{WHT}{CLR}":FOR
        {SPACE}FR=0TO39:SYSG
RA 1090 FORQ=0TO80STEP40:POKE7
        01,Q+FR*.4
HF 1100 POKE702,24:POKE700,1:S
        YSD:NEXT
HC 1110 FORQ=0TO80STEP40:POKE7
        00,3
RC 1120 POKE701,Q+FR*.6:POKE70
        2,56:SYSD
BA 1130 POKE701,Q+FR*.8:POKE70
        2,64:SYSD
KC 1140 POKE700,0:POKE701,Q+FR
        :POKE702,0
KK 1150 SYSD:POKE700,2:POKE701
        ,Q+FR*2
PK 1160 POKE702,80:SYSD:NEXTQ:
        SYSE:SYSH
RQ 1170 POKE53269,0:NEXT:POKE5
        3272,169
BK 1180 POKE53265,27:POKE56576
        ,151:SYSJ
```

APPLE.ML

```
7000:4C 05 74 4C EC 71 4C 18 79
7008:70 4C 3D 73 4C F8 71 4C 88
7010:5B 74 4C F6 74 4C EB 75 D6
7018:AE BC 02 BD FC 70 8D 9A FA
7020:70 BD 00 71 29 0F 8D CA 2B
7028:02 BD 00 71 4A 4A 4A 4A EA
7030:8D C9 02 BD 04 71 8D 52 B9
7038:70 BD 08 71 8D 53 70 A9 1D
7040:00 8D C2 02 A9 00 8D C4 2A
7048:02 A9 00 8D C3 02 AC C2 AF
7050:02 B9 FF FF 8D C5 02 EE 17
7058:C2 02 8D 76 70 A9 00 0E 6C
7060:76 70 2A 0E 76 70 2A 0E 96
7068:76 70 2A 69 64 8D 77 70 35
7070:A0 00 8C C6 02 B9 FF FF 96
7078:8D C7 02 A0 00 8C C8 02 22
7080:AD C7 02 C0 03 F0 0E C0 2F
7088:02 F0 08 C0 01 F0 02 4A CD
7090:4A 4A 4A 4A 4A 29 03 AA BE
7098:F0 31 4C A3 70 E0 03 D0 DF
70A0:02 A2 00 AD C3 02 0A 0A 4A
70A8:6D BD 02 6D C8 02 C9 A0 49
70B0:B0 19 8D C0 02 AD C4 02 40
70B8:0A 0A 0A 6D BE 02 6D C6 D8
70C0:02 C9 C8 B0 06 8D C1 02 25
70C8:20 FE 72 EE C8 02 AC C8 27
70D0:02 C0 04 D0 AB EE C6 02 19
70D8:AC C6 02 C0 08 D0 96 EE AD
70E0:C3 02 AC C3 02 CC C9 02 CE
70E8:F0 03 4C 4E 70 EE C4 02 3C
70F0:AC C4 02 CC CA 02 F0 03 A9
70F8:4C 49 70 60 2C 4C 4C 4C DD
7100:5A A4 A2 A1 0C 3E 66 7A 48
7108:71 71 71 71 FC F8 F8 F8 FB
7110:F9 F8 F8 F8 F8 F8 F8 F8 73
7118:F8 F8 F8 F8 F8 F8 F8 F8 FA
7120:F8 F8 F8 F8 F8 F8 F8 F8 03
7128:F8 F8 F8 F8 F8 F8 F8 20 32
7130:20 FB 20 20 20 20 FA 20 BF
7138:20 20 20 F7 20 20 FF FF 38
7140:FF FF FF FF FF FF FF FF 23
7148:FF FF FF FF FF FF FF FF 2B
7150:FF FF FF FF FF FF FF FF 33
7158:FF FF FF FF FF FF FF FF 3B
7160:FF FF FF FF FF FF F6 F4 26
7168:F6 F4 F6 F4 F6 F4 F6 F4 A0
7170:F5 F3 F5 F3 F5 F3 F5 F3 A8
7178:F5 F3 FE FD FE FD FE FD FE
7180:FE FD FE FD 3F FF 7C 40 55
7188:44 55 51 40 00 00 00 00 11
7190:3C FF 3F 0C 3F 3F 0F 00 4F
7198:04 15 11 00 00 00 00 00 E4
71A0:0F 3F 3F 0C AA AA AA AA 83
71A8:00 00 00 00 DD 75 57 D5 D4
71B0:DF 5D 75 77 00 40 50 D4 77
71B8:DC 5D 75 77 AA AA AA AA 87
71C0:AA AA AA AA BF AA AA AA 4C
71C8:AA AA AA AA 00 01 07 15 D2
71D0:1F 1D 75 77 C0 FC 3C 11 34
71D8:11 14 55 55 F3 F3 4F 4F A6
71E0:41 51 55 55 FF AE AE AE 7F
71E8:FF EA EA EA 20 CF 73 20 D9
71F0:92 72 20 F8 71 4C 23 72 C2
71F8:A9 40 8D 04 72 A2 20 A0 B1
7200:00 98 99 00 40 C8 D0 FA FF
7208:EE 04 72 CA D0 F4 A0 00 FB
7210:AD BF 02 99 00 60 99 00 4A
7218:61 99 00 62 99 E8 62 C8 38
7220:D0 F1 60 A0 00 A9 20 99 80
7228:00 30 99 00 31 99 00 32 6E
7230:99 E8 32 99 00 34 99 00 FF
7238:35 99 00 36 99 E8 36 C8 27
7240:D0 E5 A9 01 8D 20 D0 A9 84
7248:00 8D 21 D0 A9 05 8D 22 60
7250:D0 A9 0A 8D 23 D0 A9 C8 9A
7258:8D 68 72 A9 D8 8D 69 72 49
7260:A2 00 A0 27 BD 81 72 99 8F
7268:00 FF 88 10 FA AD 68 72 31
7270:18 69 28 8D 68 72 90 03 CA
7278:EE 69 72 E8 E0 11 D0 E2 DB
7280:60 0A 0A 0A 0A 0A 0A 0A 90
7288:09 09 09 00 00 00 00 00 55
7290:0F 0F A9 00 8D F3 72 A9 C0
7298:6C 8D F4 72 A0 27 A9 F8 CA
72A0:18 69 08 20 EC 72 88 10 41
72A8:F7 A0 1F A9 40 20 EC 72 FE
72B0:88 10 FA A0 07 A9 41 20 C8
72B8:EC 72 88 10 FA A9 C7 A2 73
72C0:18 A0 07 18 69 38 18 69 02
72C8:01 20 F2 72 88 10 F7 CA FA
72D0:10 EF A9 FE A2 05 A0 03 4C
72D8:18 69 01 18 69 01 20 E9 3F
72E0:72 88 10 F7 CA 10 EF A9 C2
72E8:1E 20 EC 72 20 EF 72 20 6F
72F0:F2 72 8D 00 6C EE F3 72 17
72F8:D0 03 EE F4 72 60 BD 39 FD
7300:73 48 AC C0 02 AE C1 02 A4
7308:B9 00 6C 18 7D 40 6D 85 28
7310:F7 B9 A0 6C 7D 08 6E 85 AA
7318:F8 AD C0 02 29 03 AA 68 32
7320:3D 35 73 85 9E A0 00 B1 E2
7328:F7 3D 31 73 05 9E 91 F7 75
7330:60 3F CF F3 FC C0 30 0C A7
7338:03 00 55 AA FF A9 00 8D 2A
7340:93 73 A9 30 8D 94 73 A9 55
7348:00 85 B2 A9 40 85 B3 A9 AA
7350:FF 85 04 A0 07 B1 B2 D0 58
7358:07 88 10 F9 A9 20 D0 32 28
7360:A9 00 85 05 C6 05 A5 05 B7
7368:C5 04 F0 10 20 BD 73 A0 D1
7370:07 B1 B2 D1 F9 D0 ED 88 32
7378:10 F7 30 14 A5 04 C9 40 BD
7380:90 35 20 BD 73 A0 07 B1 BA
7388:B2 91 F9 88 10 F9 C6 04 EE
7390:A5 05 8D FF FF EE 93 73 93
7398:D0 03 EE 94 73 A5 B2 18 7F
73A0:69 08 85 B2 90 02 E6 B3 28
73A8:AD 93 73 C9 E8 D0 A4 AD D7
73B0:94 73 C9 33 D0 9D 60 A9 92
73B8:02 8D 20 D0 60 85 F9 A9 CB
73C0:00 06 F9 2A 06 F9 2A 06 7D
73C8:F9 2A 69 20 85 FA 60 78 B7
73D0:A9 33 85 01 A9 D0 8D E9 AF
73D8:73 A9 20 8D EC 73 A9 28 71
73E0:8D EF 73 A0 08 A2 00 BD 8B
73E8:00 D0 9D 00 20 9D 00 28 57
73F0:E8 D0 F4 EE E9 73 EE EC F5
73F8:73 EE EF 73 88 D0 E8 A9 8D
7400:37 85 01 58 60 A9 30 8D 23
7408:FE FF A9 78 8D FF FF A9 43
7410:00 85 02 A9 FE 85 FD A9 E8
7418:FF 85 FE A9 00 8D CD 74 23
7420:A9 85 8D CE 74 78 A9 33 E9
7428:85 01 A9 D0 8D 3A 74 A9 3E
7430:64 8D 3D 74 A0 08 A2 00 08
7438:BD 00 D0 9D 00 64 E8 D0 28
7440:F7 EE 3A 74 EE 3D 74 88 4D
7448:D0 EE A9 37 85 01 58 A2 81
7450:68 BD 83 71 9D 97 6B CA 51
7458:D0 F7 60 A5 FE F0 07 C9 A1
7460:D0 B0 03 4C 35 A4 A9 00 92
7468:85 05 A9 00 85 F7 A9 28 12
7470:85 F8 A6 02 A5 FD 9D 95 45
7478:81 A5 FE 9D BD 81 A9 00 8C
7480:85 01 C6 05 A5 05 C5 04 66
7488:F0 21 A5 FD 38 E9 08 85 C5
7490:FD B0 02 C6 FE A5 F7 38 08
7498:E9 08 85 F7 B0 02 C6 F8 BC
74A0:A0 07 B1 F7 91 FD 88 10 F6
74A8:F9 30 D7 A9 14 8D CA 74 11
74B0:A9 30 8D CB 74 A6 02 AD D8
74B8:CD 74 9D 45 81 AD CE 74 82
74C0:9D 6D 81 E6 02 A0 0C A2 BF
74C8:09 BD 00 FF 9D 00 85 CA 68
74D0:10 F7 AD CD 74 18 69 0A 33
74D8:8D CD 74 90 03 EE CE 74 79
74E0:AD CA 74 18 69 28 8D CA 35
74E8:74 90 03 EE CB 74 88 D0 91
74F0:D6 A9 37 85 01 60 A6 03 C8
74F8:BD 95 81 85 FB BD BD 81 82
7500:38 E9 04 85 FC BD 45 81 45
7508:8D 64 75 BD 6D 81 8D 65 4F
7510:75 A9 00 85 F7 A9 C8 8D FD
7518:67 75 A9 D2 8D 6A 75 A9 21
7520:DC 8D 6D 75 A9 E6 8D 70 56
7528:75 A2 24 A0 30 A9 C9 CD 8E
7530:18 D0 D0 06 A2 2C A0 34 11
7538:A9 DB 86 F8 8C 68 75 8C CC
7540:6B 75 8C 6E 75 8C 71 75 EC
7548:48 A9 00 85 01 A2 04 A0 55
7550:00 B1 FB 91 F7 C8 D0 F9 BE
7558:E6 FC E6 F8 CA D0 F2 A0 82
7560:00 A2 09 BD 00 85 9D 00 42
```

```
7568:FF 9D 00 FF 9D 00 FF 9D 45
7570:00 FF CA 10 EE AD 64 75 22
7578:18 69 0A 8D 64 75 90 03 01
7580:EE 65 75 AD 67 75 18 79 80
7588:E0 75 8D 67 75 90 03 EE 4C
7590:68 75 AD 6A 75 18 79 E0 49
7598:75 8D 6A 75 90 03 EE 6B 20
75A0:75 AD 6D 75 18 79 E0 75 94
75A8:8D 6D 75 90 03 EE 6E 75 93
75B0:AD 70 75 18 79 E0 75 8D 86
75B8:70 75 90 03 EE 71 75 C8 6C
75C0:C0 0C D0 9D A9 37 85 01 39
75C8:AD 12 D0 C9 52 90 0C C9 7C
75D0:E3 B0 08 C9 AB 90 F1 C9 C4
75D8:D2 B0 ED 68 8D 18 D0 60 6C
75E0:28 28 28 28 28 28 28 28 CB
75E8:28 F0 28 20 23 72 A9 00 61
75F0:85 03 20 F6 74 A9 02 20 41
75F8:8B 77 20 06 77 A2 00 A9 DB
7600:00 9D 00 84 E8 D0 FA A9 C6
7608:7B 8D 17 76 A9 3A 8D 1A CB
7610:76 A0 06 A2 00 BD 1D 7B F7
7618:9D 80 3A E8 D0 F7 EE 17 25
7620:76 EE 1A 76 88 D0 EE A9 BD
7628:00 8D 9F 84 8D A0 84 A9 56
7630:01 8D 86 02 8D 20 D0 A9 2A
7638:00 8D 21 D0 A9 05 8D 25 5B
7640:D0 A9 0A 8D 26 D0 20 44 13
7648:E5 A9 03 8D 9C 84 A9 81 97
7650:8D 12 D4 8D 0F D4 A9 8F AA
7658:8D 18 D4 78 A9 43 8D 14 BD
7660:03 A9 78 8D 15 03 58 20 A6
7668:23 72 20 21 77 A0 00 A2 7A
7670:00 20 48 7A A9 00 8D 50 CE
7678:84 8D 30 84 8D 38 84 8D 3D
7680:98 84 A9 FF 8D 99 84 A9 95
7688:8C 8D 00 84 A9 A7 8D 08 76
7690:84 20 C9 7A 20 2A 7A A9 F0
7698:2C 8D 43 78 38 6E 9D 84 2A
76A0:20 2B 77 A5 03 18 6D 9A 9F
76A8:84 C9 28 90 02 A9 00 85 94
76B0:03 20 F6 74 AD 9A 84 F0 1F
76B8:18 A2 01 BD 10 84 18 69 82
76C0:C0 9D 10 84 BD 00 84 69 20
76C8:01 9D 00 84 E8 E0 08 D0 91
76D0:EA AD 9D 84 10 C6 AD 43 D4
76D8:78 C9 4C D0 C6 20 10 77 59
76E0:CE 9C 84 20 2B 77 AD 9C 1E
76E8:84 F0 0B A9 00 8D 15 D0 81
76F0:20 10 77 4C 6D 76 A9 00 3E
76F8:8D 15 D0 A9 01 20 8B 77 BD
7700:20 10 77 4C F2 75 AD 00 7F
7708:DC 29 1F C9 1F F0 F7 60 3D
7710:20 13 77 20 16 77 A2 00 98
7718:A0 00 88 D0 FD CA D0 FA 2D
7720:60 A0 06 20 82 77 A2 03 64
7728:20 98 77 AD 9F 84 AC A0 20
7730:84 85 63 84 62 A2 90 38 6E
7738:20 49 BC 20 E2 BA 20 DD 43
7740:BD A2 FF E8 BD 02 01 D0 0E
7748:FA F0 11 A9 30 8D 00 01 66
7750:A0 05 B9 00 01 99 01 01 79
7758:88 10 F7 E8 E0 04 D0 EB C1
7760:A0 0C 20 82 77 A9 01 A8 DB
7768:20 9E 77 A0 20 20 82 77 06
7770:AD 9C 84 18 69 30 8D 80 17
7778:77 A9 80 A0 77 4C 9E 77 49
7780:00 00 8C D2 77 A2 17 8E 31
7788:D3 77 60 AA BD DE 77 8D DB
7790:D2 77 BD E0 77 8D D3 77 9D
7798:BD E2 77 BC E5 77 8D B4 B6
77A0:77 8C B6 77 A9 30 8D 88 6E
77A8:02 AC D2 77 AE D3 77 18 61
77B0:20 F0 FF A9 00 A0 00 20 29
77B8:1E AB A9 34 8D 88 02 AC 59
77C0:D2 77 AE D3 77 18 20 F0 57
77C8:FF AD B4 77 AC B6 77 4C AC
77D0:1E AB 00 00 A2 A0 A9 20 C4
77D8:9D 77 04 CA D0 FA 60 0F E3
77E0:09 06 06 E9 F3 0B 77 77 67
77E8:78 47 41 4D 45 20 4F 56 82
77F0:45 52 00 05 50 55 53 48 2E
77F8:20 4A 4F 59 53 54 49 43 CB
7800:4B 20 54 4F 20 53 54 41 56
7808:52 54 00 53 43 4F 52 45 AD

7810:3A 1D 1D 1D 1D 20 20 20 A4
7818:20 20 20 20 20 20 20 4C 35
7820:49 56 45 53 3A 00 A9 00 4E
7828:85 01 68 A8 68 AA 68 40 B2
7830:48 8A 48 98 48 A9 78 48 9C
7838:A9 26 48 08 48 48 48 A9 AE
7840:37 85 01 2C 9D 80 A2 07 4C
7848:BD 50 84 F0 29 DE 60 84 D5
7850:D0 24 9D 60 84 DE 58 84 41
7858:F0 09 FE F8 33 FE F8 37 32
7860:4C 76 78 BD 68 84 F0 0B 42
7868:DE 68 84 D0 06 20 AE 7A 09
7870:4C 76 78 20 83 7A CA 30 02
7878:07 D0 CD 2C 98 84 10 C8 5D
7880:2C 98 84 30 57 AD 00 DC 8F
7888:29 12 F0 07 29 10 D0 03 4F
7890:8D 99 84 AD 00 DC 49 1F 3F
7898:29 16 CD 99 84 F0 3D 8D E6
78A0:99 84 29 06 4A 4A 8D 9A 36
78A8:84 B0 1D AD 99 84 29 10 C7
78B0:F0 12 A9 00 8D 30 84 A9 B3
78B8:FC 8D 38 84 8D 98 84 A9 5C
78C0:01 8D 34 03 A0 00 F0 07 3A
78C8:A9 00 8D 9A 84 A0 01 A2 35
78D0:00 20 48 7A AE 9A 84 D0 34
78D8:03 8E 50 84 A2 07 BD 10 FD
78E0:84 18 7D 20 84 9D 10 84 0B
78E8:BD 00 84 7D 28 84 9D 00 AF
78F0:84 BD 18 84 18 7D 30 84 7A
78F8:9D 18 84 BD 08 84 7D 38 B0
7900:84 9D 08 84 CA 10 D7 2C 58
7908:98 84 10 2B AD 30 84 18 6C
7910:69 48 8D 30 84 AD 38 84 4E
7918:69 00 8D 38 84 A9 A7 CD DC
7920:08 84 B0 13 8D 08 84 A9 BE
7928:00 8D 30 84 8D 38 84 8D B0
7930:98 84 A9 03 8D 34 03 AD E6
7938:1E D0 2D 15 D0 4A 90 4E 84
7940:0A A2 07 0A 90 22 BD 00 EA
7948:84 38 ED 00 84 B0 04 49 81
7950:FF 69 01 C9 0C B0 11 BD 5D
7958:08 84 38 ED 08 84 B0 04 0E
7960:49 FF 69 01 C9 2A 90 05 52
7968:CA D0 D8 F0 21 BD 80 84 A4
7970:F0 03 20 FD 7A BD 88 84 E0
7978:8D 3B 03 BD 90 84 30 06 3A
7980:20 AE 7A 4C 8E 79 A9 4C 3D
7988:8D 43 78 4C 05 7A AD 9B EF
7990:84 F0 05 CE 9B 84 D0 56 76
7998:A9 28 20 E1 7A 18 69 28 BB
79A0:8D 9B 84 A2 07 AD 15 D0 E5
79A8:0A 90 07 CA E0 01 B0 F8 B7
79B0:90 3C A9 00 9D 00 84 A9 CF
79B8:03 20 E1 7A A8 B9 08 7A CF
79C0:9D 80 84 B9 0C 7A 9D 90 E4
79C8:84 B9 10 7A 9D 08 84 B9 E5
79D0:14 7A 9D 20 84 B9 18 7A D7
79D8:9D 28 84 B9 20 7A 9D 88 7F
79E0:84 B9 1C 7A A8 20 48 7A 80
79E8:20 C9 7A 20 2A 7A A2 07 37
79F0:BD 00 84 C9 F0 90 03 20 DF
79F8:AE 7A CA 10 F3 A2 07 20 94
7A00:C9 7A CA 10 FA 4C 9D 80 97
7A08:00 00 00 0A 80 80 80 00 A4
7A10:9A B0 BC C6 30 00 C0 00 85
7A18:01 01 00 00 02 02 03 04 EF
7A20:02 02 02 04 00 80 00 FF 19
7A28:0A 32 AD 15 D0 1D 0D 7B 46
7A30:8D 15 D0 60 EA FA FB FD 8A
7A38:FF 10 01 02 02 01 02 00 89
7A40:0A 08 00 6A 6A 72 A0 22 63
7A48:B9 34 7A 9D 40 84 B9 39 11
7A50:7A 9D 48 84 B9 3E 7A 9D 94
7A58:50 84 B9 43 7A 29 01 9D 1A
7A60:68 84 B9 43 7A 4A 4A 4A F1
7A68:4A 9D 27 D0 98 48 B9 43 78
7A70:7A 4A 48 4A 48 4A 20 C5 54
7A78:7A 68 20 9C 7A 68 20 99 E1
7A80:7A 68 A8 BD 40 84 9D F8 06
7A88:33 9D F8 37 BD 50 84 9D E6
7A90:60 84 BD 48 84 9D 58 84 E2
7A98:60 A0 1C 2C A0 1D 4A B9 F3
7AA0:00 D0 3D 15 7B 90 03 1D 04
7AA8:0D 7B 99 00 D0 60 AD 15 AE
7AB0:D0 3D 15 7B 8D 15 D0 A9 C3

7AB8:00 9D 68 84 9D 70 84 9D BF
7AC0:78 84 20 9C 7A A0 17 D0 36
7AC8:D5 8A 0A A8 BD 10 84 0A 58
7AD0:BD 00 84 2A 99 00 D0 BD 04
7AD8:08 84 99 01 D0 A0 10 D0 30
7AE0:BE 85 9F A9 FF 85 9E A5 1E
7AE8:9F D0 03 60 46 9E 0A 90 99
7AF0:FB AD 1B D4 25 9E C5 9F CE
7AF8:F0 02 B0 F5 60 18 6D 9F 3A
7B00:84 8D 9F 84 90 03 EE A0 E7
7B08:84 4E 9D 84 60 01 02 04 DF
7B10:08 10 20 40 80 FE FD FB 0F
7B18:F7 EF DF BF 7F A0 2A 00 D1
7B20:2A AA A8 00 FC 28 0F F0 83
7B28:00 00 3F 00 00 0F 00 00 43
7B30:0A 00 00 22 80 00 AA 80 28
7B38:00 8A 80 00 AA 80 00 8A C3
7B40:80 00 AB 00 00 EB C0 00 1E
7B48:2A 00 00 2A 00 00 2A 00 4B
7B50:00 2A 00 00 2A 00 00 AA CD
7B58:00 02 AA 00 00 A0 2A 00 FB
7B60:2A AA A8 00 FC 28 0F F0 C3
7B68:00 00 3F 00 00 0F 00 00 83
7B70:0A 00 00 22 80 00 AA 80 68
7B78:00 8A 80 00 AA 80 00 8A 04
7B80:80 00 AE 00 00 2F 00 00 4A
7B88:2A 00 00 2A 00 00 2A 00 8B
7B90:00 2A 00 00 2A 80 02 AA 14
7B98:80 00 2A 80 00 A0 2A 00 F3
7BA0:2A AA A8 00 FC 28 0F F0 04
7BA8:00 00 3F 00 00 0F 00 00 C3
7BB0:0A 00 00 22 80 00 AA 80 A8
7BB8:00 8A 80 00 AA 80 00 AA 64
7BC0:80 00 BA 00 00 3E C0 00 C9
7BC8:2A 00 00 2A 00 00 AA 80 4D
7BD0:00 A2 80 00 A2 A0 0A A0 CC
7BD8:A0 00 0A A0 00 00 00 00 6B
7BE0:A0 2A 00 2A AA A8 00 FC 4A
7BE8:28 0F F0 00 00 3F 00 00 D2
7BF0:0F 00 00 0A 00 00 22 80 D4
7BF8:00 AA 80 00 8A 80 00 AA AB
7C00:80 00 AA 80 00 EA C0 00 C3
7C08:FA F0 00 AA 80 02 AA 80 47
7C10:02 82 80 02 80 A0 02 80 E5
7C18:28 2A 82 A8 00 00 00 00 8A
7C20:A0 2A 00 2A AA A8 00 FC 8B
7C28:28 0F F0 00 00 3F 00 00 14
7C30:0F 00 00 0A 00 00 22 80 16
7C38:00 AA 80 00 8A 80 00 AA EC
7C40:80 00 AA A0 03 AA 30 03 FE
7C48:EA 3C 00 AA 80 00 A2 80 3A
7C50:02 80 A0 02 80 A0 0A 00 39
7C58:28 AA 02 A8 AA 00 00 00 30
7C60:A0 2A 00 2A AA A8 00 FC CB
7C68:28 0F F0 00 00 3F 00 00 54
7C70:0F 00 00 0A 00 00 22 80 56
7C78:00 AA 80 00 8A 80 00 AA 2D
7C80:80 00 AA A0 03 AA 30 03 3F
7C88:EA 3C 00 2A 00 00 A2 80 6E
7C90:00 A2 80 00 A0 A0 02 80 4E
7C98:A8 2A 82 80 2A A0 2A 00 F0
7CA0:2A AA A8 00 FC 28 0F F0 06
7CA8:00 00 3F 00 00 0F 00 00 C5
7CB0:0A 00 00 22 80 00 AA 80 AA
7CB8:00 8A 80 00 AA A0 02 AA EA
7CC0:20 03 AA 30 03 EA 3C 00 1F
7CC8:2A 00 00 2A 00 00 2A 80 4E
7CD0:00 A2 80 00 A0 A0 00 AA B4
7CD8:80 0A A0 00 00 A0 2A 00 7F
7CE0:2A AA A8 00 FC 28 0F F0 46
7CE8:00 00 3F 00 00 0F 00 00 06
7CF0:0A 00 00 22 80 00 AA 80 EA
7CF8:00 8A 80 00 AA 80 00 AA A6
7D00:80 00 EA C0 00 FA F0 00 72
7D08:2A 00 00 2A 00 00 2A 00 0F
7D10:00 2A 80 00 2A 80 00 2A 23
7D18:00 02 A8 00 00 A0 2A 00 7F
7D20:2A AA A8 00 FC 28 0F F0 87
7D28:00 00 3F 00 00 0F 00 00 47
7D30:0A 00 00 22 80 00 AA 80 2C
7D38:00 8A 80 00 AA 80 00 8A C7
7D40:80 00 BA 00 00 3E C0 00 4D
7D48:2A 00 00 2A 00 00 2A 00 4F
7D50:00 2A 00 00 2A 00 00 AA D1
7D58:00 02 AA 00 00 A0 2A 00 FF
```

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7D60:2A AA A8 00 FC 28 0F F0 C7
7D68:00 00 3F 00 00 0F 00 00 87
7D70:0A 00 00 22 80 00 AA 80 6C
7D78:00 8A 80 00 AA 80 00 8A 08
7D80:80 00 AE 00 00 2F 00 00 4E
7D88:2A 00 00 2A 00 00 2A 00 8F
7D90:00 2A 00 00 2A 80 02 AA 18
7D98:80 00 2A 80 00 A0 2A 00 F7
7DA0:2A AA A8 00 FC 28 0F F0 08
7DA8:00 00 3F 00 00 0F 00 00 C7
7DB0:0A 00 00 22 80 00 AA 80 AC
7DB8:00 8A 80 00 AA 80 00 8A 48
7DC0:80 00 AB 00 00 2B C0 00 9F
7DC8:2A 00 00 2A 00 00 AA 80 51
7DD0:00 A2 80 00 A0 A0 0A A0 C0
7DD8:A0 00 0A A0 00 00 00 00 6F
7DE0:A0 2A 00 2A AA A8 00 FC 4E
7DE8:28 0F F0 00 00 3F 00 00 D6
7DF0:0F 00 00 0A 00 00 22 80 D8
7DF8:00 AA 80 00 8A 80 00 AA AF
7E00:A0 00 8A A0 00 AA C0 00 D4
7E08:EA F0 00 AA 00 02 AA 80 3F
7E10:02 82 80 02 80 A0 02 80 E9
7E18:28 2A 82 A8 00 00 00 00 8E
7E20:A0 2A 00 2A AA A8 00 FC 8F
7E28:28 0F F0 00 00 3F 00 00 18
7E30:0F 00 00 0A 00 00 22 80 1A
7E38:00 AA A0 00 8A A0 00 AA 75
7E40:20 00 8A 28 03 AA 30 03 47
7E48:EA 3C 00 AA 80 00 A2 80 3E
7E50:02 80 A0 02 80 A0 0A 00 3D
7E58:28 AA 00 AA AA 00 00 00 14
7E60:A0 2A 00 2A AA A8 00 FC CF
7E68:28 0F F0 00 00 3F 00 00 58
7E70:0F 00 00 0A 00 00 22 80 5A
7E78:00 AA A0 00 8A A0 02 AA B9
7E80:20 02 8A 28 0C AA 30 0F 5C
7E88:2A 3C 00 2A 00 00 A2 80 12
7E90:00 A2 80 00 A0 A0 02 80 52
7E98:A8 02 82 80 2A A0 2A 00 EA
7EA0:2A AA A8 00 FC 28 0F F0 0A
7EA8:00 00 3F 00 00 0F 00 00 C9
7EB0:0A 00 00 22 80 00 AA A0 CE
7EB8:00 8A A0 02 AA 20 02 8A F0
7EC0:28 0C AA 30 0F 2A 3C 00 C6
7EC8:2A 00 00 2A 00 00 2A 80 52
7ED0:00 A2 80 00 A0 A0 00 AA B8
7ED8:80 0A A0 00 00 A0 2A 00 83
7EE0:2A AA A8 00 FC 28 0F F0 4A
7EE8:00 00 3F 00 00 0F 00 00 0A
7EF0:0A 00 00 22 80 00 AA 80 EE
7EF8:00 8A 80 00 AA 80 00 8A 8A
7F00:A0 03 AA C0 03 EA F0 00 17
7F08:2A 00 00 2A 00 00 2A 00 13
7F10:00 2A 80 00 2A 80 00 2A 27
7F18:00 02 A8 00 00 00 00 00 AC
7F20:00 00 00 00 00 00 00 00 1F
7F28:00 00 00 00 A0 2A 00 2A FE
7F30:AA A8 00 FC 28 0F F0 00 DD
7F38:00 3F 00 00 0F 00 00 22 A1
7F40:80 00 AA A0 02 8A A8 0A 74
7F48:AA 2A 3C 8A 0F 30 AA 03 E8
7F50:00 2A 00 00 AA 88 02 AA FF
7F58:AA 02 A2 A2 02 00 00 00 BB
7F60:00 00 00 00 00 00 00 00 5F
7F68:00 00 00 00 00 00 00 00 67
7F70:00 00 00 00 00 00 00 00 6F
7F78:00 00 00 00 00 00 00 00 77
7F80:40 14 01 40 05 05 40 05 8A
7F88:45 00 01 55 50 54 54 1A 36
7F90:15 55 58 05 54 50 00 00 AE
7F98:00 00 00 00 00 00 00 00 97
7FA0:00 00 00 00 00 00 00 00 9F
7FA8:00 00 00 00 00 00 00 00 A7
7FB0:00 00 00 00 00 00 00 00 AF
7FB8:00 00 00 00 00 00 00 00 B7
7FC0:00 00 00 00 00 00 00 01 C0
7FC8:51 50 55 55 1A 15 15 58 2C
7FD0:04 54 50 01 55 00 05 41 F6
7FD8:40 05 00 40 00 00 00 00 3D
7FE0:00 00 00 00 00 00 00 00 DF
7FE8:00 00 00 00 00 00 00 00 E7
7FF0:00 00 00 00 00 00 00 00 EF
7FF8:00 00 00 00 00 00 00 00 F7
8000:00 00 00 00 00 00 00 00 01
8008:00 00 00 00 00 00 F0 00 EA
8010:01 F8 1F 83 0C 79 E6 07 07
8018:EF 3C 03 86 00 00 00 00 E8
8020:00 00 00 00 00 00 00 00 21
8028:00 00 00 00 00 00 00 00 29
8030:00 00 00 00 00 00 00 00 31
8038:00 00 00 00 00 00 00 00 39
8040:00 00 00 00 00 00 00 00 41
8048:00 00 00 00 00 38 03 C0 F0
8050:7E 07 EF C7 0C 79 81 F8 0F
8058:1F 00 F0 06 00 00 04 00 6F
8060:01 14 00 01 50 00 00 10 89
8068:00 00 88 00 02 AA 00 02 37
8070:AA 00 02 AA 00 02 AA 00 0F
8078:02 AA 00 02 AA 00 00 A8 43
8080:00 00 00 00 00 00 00 00 81
8088:00 00 00 00 00 00 00 00 89
8090:00 00 00 00 00 00 00 00 91
8098:00 00 00 00 00 A2 0D BD FB
80A0:46 03 9D 00 D4 CA 10 F7 23
80A8:A2 07 BC 34 03 F0 3F 88 7A
80B0:98 0A 0A 0A A8 A9 00 9D EB
80B8:34 03 9D 05 D4 9D 06 D4 96
80C0:BD 4A 03 29 FE 9D 04 D4 71
80C8:A9 06 8D 37 03 8E DE 80 D5
80D0:B9 1D 81 9D 47 03 C8 E8 C0
80D8:CE 37 03 D0 F3 A2 00 B9 60
80E0:1D 81 9D 36 03 B9 1E 81 A4
80E8:9D 35 03 18 90 25 DE 35 F3
80F0:03 D0 08 BD 4A 03 29 FE 34
80F8:9D 4A 03 BD 47 03 18 7D 8B
8100:36 03 9D 47 03 6A 5D 36 B9
8108:03 10 08 A9 00 9D 06 D4 83
8110:9D 4C 03 8A F0 04 A2 00 DA
8118:F0 90 4C 7E EA 08 00 08 A8
8120:41 00 FF 06 03 86 00 08 5E
8128:41 00 FF FC 03 8E 00 08 F5
8130:81 00 F5 00 02 C0 00 08 CD
8138:41 00 F3 F2 0D 03 00 08 06
8140:21 10 F3 00 10 00 00 00 D6
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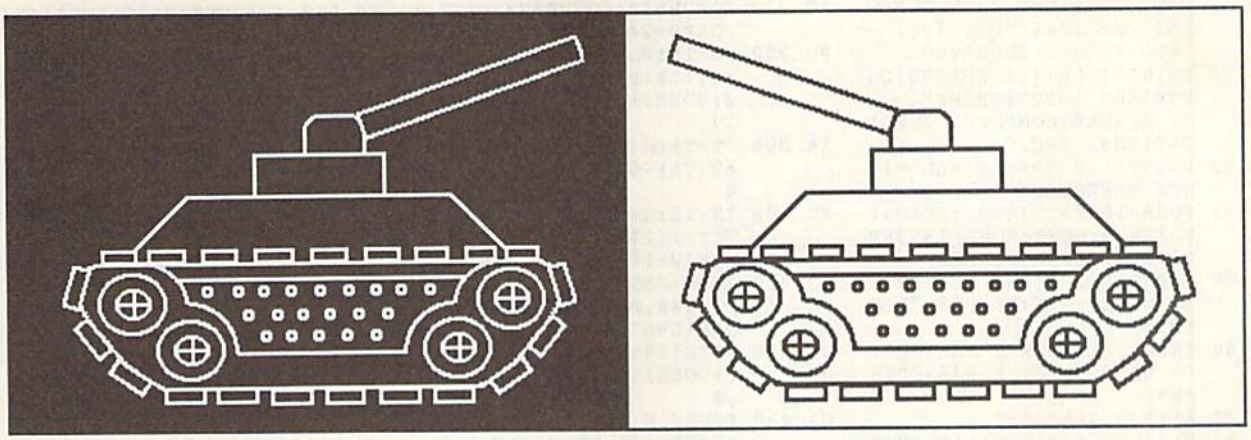


THINK TANK

Fred Karg

Assume the role of a futuristic tank commander in this two-player strategy game for the 64.

In this day and age, all military weapons are computerized. Manned war machines have become obsolete. Now the great battle leaders are master strategists and great programmers. And you should know—you're the most respected cybertank commander in the world. You proved yourself in the Void Wars, and now you're needed again.

Getting Started

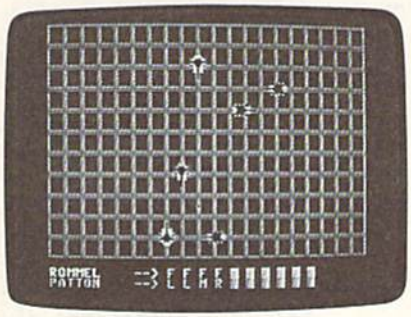
Think Tank is written entirely in BASIC. To ensure accurate typing, enter the program using *The Automatic Proofreader*, found elsewhere in this issue. When you've finished typing, be sure to save a copy of the program to disk.

When you're ready to do battle, load and run the program. First, you're asked to type in the names of the two combatants. After you've entered the players' names, the battlefield is displayed with six tanks in place.

Each player has three programmable tanks at his or her disposal. Player 1 controls the white tanks, while Player 2 controls the yellow ones. The object of the game is simple: The first player to destroy all of the opponent's tanks wins.

Programming the Tanks

Players control their tanks by entering a series of ten secret instructions on the command lines located at the bottom of the screen. To program your tanks, first select the tank that you wish to maneuver. One of your three tanks constantly flashes, indicating that it's ready to receive orders. You can program this tank or select another by pressing the space bar. Once you've chosen a tank to program, begin issuing orders on the command line. Press M to move forward, R to turn right, L to turn left, and F to fire the tank cannon. You can switch tanks as often as you like during the command-entry process.



Plan your strategy carefully. Once you've dispatched your orders, the action begins.

Initially, each command line appears as a row of X's. To help you conceal your movements from your opponent, an inverse space is substituted for an X every time you issue a command. If you make a mistake while entering a command, press the delete key to clear the last instruction.

The battle begins when both players have completed their programming. The command-line orders are dispatched to the respective tanks, alternating between players, until all orders are exhausted or a winner is declared. If there is no winner, players must reprogram their tanks for another round of engagement.

Hints and Tips

Programming the tanks is easy, but choosing the appropriate strategy can be difficult. You must think some ten moves ahead or move in front of your opponent. The following are a few hints that may improve your odds and help you formulate a plan of attack.

When programming your tanks, keep in mind that orders are dispatched on a sequential basis. Orders given to tanks that have been destroyed are ignored, causing you to lose valuable turns. So, it's not a good idea to give all ten of your orders to one tank.

If two tanks collide, both are destroyed. Keep this in mind; a situation may arise when ramming the enemy's tank is more appropriate than shooting it with cannon fire.

Tanks' movements are confined to the inside of the grid. Any moves directing a tank past the boundaries will cause the tank to hit a wall. It won't damage the tank, but it could put your tank at a disadvantage. ▷

Think Tank

```
HQ 10 REM COPYRIGHT 1990 COMPU
      TE! PUBLICATIONS, INC. -
       ALL RIGHTS RESERVED
FE 20 PRINT"{CLR}{12 SPACES}CO
      PYRIGHT 1990":PRINT"
      {7 SPACES}COMPUTE! PUBLI
      CATIONS, INC."
EB 30 PRINT"{10 SPACES}ALL RIG
      HTS RESERVED"
FR 40 FORA=16000TO16383:READN:
      POKEA,N:NEXT:FORA=15936T
      O15999:POKEA,0:NEXT
AG 50 INPUT "{2 DOWN} PLAYER 1
      'S NAME";P1$:IF P1$=""TH
      EN50
QR 60 INPUT "{2 DOWN} PLAYER 2
      'S NAME";P2$:IF P2$=""TH
      EN60
XP 70 A$="{9 SPACES}"
SQ 80 P1$=LEFT$(P1$,9):IFLEN(P
      1$)<9THENP1$=P1$+LEFT$(A
      $,9-LEN(P1$))
JA 90 P2$=LEFT$(P2$,9):IFLEN(P
      2$)<9THENP2$=P2$+LEFT$(A
      $,9-LEN(P2$))
HG 100 H(1)=27:H(2)=27:H(3)=43
       :H(4)=59:H(5)=59:H(6)=4
       3:W0=0:V=53248:S=54272
XD 110 V(1)=70:V(4)=54:V(3)=10
       2:V(2)=198:V(5)=182:V(6
       )=150:IN=4:MO=4:GOSUB59
       0
HF 120 FORTA=1TO6:GOSUB650:NEX
       T:POKEV+21,126
EX 130 POKES+16,250:POKES+17,7
       :POKES+24,8:POKES+14,40
DB 140 FORTA=1TO6:FORL=1TO10:M
       $(TA,L)="X":NEXT:NEXT:P
       OKE198,0:PRINT:PRINT"
       {WHT}"P1$;
AG 150 PRINT" --> V V V V V V
       {SPACE}V V V V":PRINT"
       {YEL}"P2$" --> V V V V
       {SPACE}V V V V V V";
CF 160 FORXX=1TO2:POKE781,23+P
       L:POKE782,14:POKE783,PE
       EK(783)AND254:SYS65520
EJ 170 IFPL=0THENTA=1:POKE646,
       1
RK 180 IFPL=1THENTA=4:POKE646,
       7
GP 190 GOSUB790:IFXX=1THENPL=A
       BS(PL-1)
BQ 200 NEXT:L=1
BH 210 IFPL=1THENFORTA=1TO6
SG 220 IFPL=0THENFORTA=6TO1STE
       P-1
FP 230 IFM$(TA,L)="X"THEN300
HC 240 PP=PEEK(2040+TA):IFPP=2
       50THEN300
RQ 250 POKES+14,180+TA*10:C=0:
       FORN=1TO5:IFM$(TA,L)=MI
       D$("LRMF",N,1)THENC=N
GX 260 NEXT:BR=0:IFTA>3THENBR=
       40
SC 270 POKE1956+L*2+BR,ASC(M$(
       TA,L))-64:ONCGOSUB320,3
       40,360,380
MF 280 IFPEEK(2040+TA)<>250THE
       NPOKE2040+TA,PP
DF 290 IFW0<>0THENGOTO100
RM 300 NEXT:L=L+1:IFL<11THEN21
       0
EA 310 PRINT"{3 UP}":GOTO130
BM 320 PP=PP+1:IFPP=256THENPP=
       252
DM 330 RETURN
XK 340 PP=PP-1:IFPP=251THENPP=
       255
PQ 350 RETURN
DE 360 POKES+24,15:FORWW=1TOMO
       :ONPP-251GOSUB480,520,5
       40,570
AC 370 GOSUB650:GOSUB900:NEXT:
       POKES+24,8:RETURN
PD 380 VO=15:POKES+24,VO:POKES
       +4,128:POKES+4,129:K=15
       0:POKES+11,16:POKES+11,
       17
XA 390 TT=TA:H(0)=H(TA)+2:V(0)
       =V(TA)-6:TA=0:BO=0:IN=1
       6
KD 400 IN=16:N=(PEEK(V+16)AND2
       ↑TT)/(2↑TT):POKEV+16,(P
       EEK(V+16)AND254)ORN
GJ 410 IFPP=255ORPP=253THENPOK
       E15988,0:POKE15964,48:P
       OKE15967,48:GOTO430
JB 420 POKE15988,60:POKE15964,
       0:POKE15967,0:POKE15970
       ,0
GA 430 POKEV,H(0):POKEV+1,V(0)
       :POKEV+21,PEEK(V+21)+1
PG 440 K=K-1:ONPP-251GOSUB480,
       520,540,570:GOSUB650:PO
       KES+8,K:GOSUB660
XK 450 IFBO=1ANDTA=0ANDHI=0THE
       NPOKEV+21,PEEK(V+21)-1:
       POKES+11,16
HJ 460 VO=VO-.5:POKES+24,VO:IF
       BO=0ANDHI=0THEN440
PM 470 POKES+11,16:TA=TT:IN=4:
       RETURN
CE 480 H(TA)=H(TA)-IN:IFH(TA)<
       22AND(PEEK(V+16)AND2↑TA
       )/(2↑TA)=0THENH(TA)=27:
       BO=1
EJ 490 IFH(TA)<0THENH(TA)=255+
       H(TA):POKEV+TA*2,H(TA):
       GOTO510
QF 500 RETURN
JX 510 POKEV+(16),(PEEK(V+16)A
       ND(255-(2↑TA))):RETURN
MM 520 V(TA)=V(TA)+IN:IFV(TA)>
       204THENV(TA)=198:BO=1
JH 530 RETURN
XQ 540 H(TA)=H(TA)+IN:IF(H(TA)
       >65AND(PEEK(V+16)AND2↑T
       A)/(2↑TA)=1)THENH(TA)=5
       9:BO=1
XE 550 IFH(TA)>255THENH(TA)=H(
       TA)-255:POKEV+16,(PEEK(
       V+16)OR(2↑TA))
EK 560 RETURN
DF 570 V(TA)=V(TA)-IN:IFV(TA)<
       49THENV(TA)=54:BO=1
QP 580 RETURN
BF 590 POKE53281,14:PRINT"
       {CLR}{6}";:POKE53280,14
       :FORC=1TO11:FORN=1TO20:
       PRINT"{OFF}OP";:NEXT
DE 600 FORN=1TO20:PRINT"L@";:N
       EXT:NEXT:FORN=0TO63:POK
       E15936+N,0:NEXT:POKE204
       1,253
EM 610 POKE2042,255:POKE2044,2
       53:POKE2045,255:POKE204
       3,254:POKE2046,252
FQ 620 POKE2040,249:POKEV+16,1
       12:POKEV+37,2:POKEV+38,
       0:POKEV+28,255:FORN=STO
       S+24
SP 630 POKEN,P:NEXT:POKES+5,12
       :POKES+1,10:POKES+12,1:
       POKES+13,169
RS 640 FORN=1TO3:POKEV+39+N,1:
       NEXT:FORN=4TO6:POKEV+39
       +N,7:NEXT:POKEV+39,0
XH 650 POKEV+TA*2,H(TA):POKEV+
       TA*2+1,V(TA):RETURN
CH 660 HI=0:FORN=1TO6:IFN=TTTH
       EN710
FG 670 IFABS(H(0)-H(N))>8THEN7
       10
SA 680 IFABS(V(0)-V(N))>8THEN7
       10
FP 690 IF(PEEK(V+16)AND1)<>(PF
       EK(V+16)AND2↑N)/(2↑N)TH
       EN710
KJ 700 IFPEEK(2040+N)<>250THEN
       HI=1:SP=N
HF 710 NEXT:IFHI=0THENRETURN
XQ 720 IFCL=0THENPOKEV+21,PEEK
       (V+21)-1
SK 730 POKE2040+SP,251:POKES+2
       4,15:POKES+4,128:POKES+
       4,129:POKES+11,129
PQ 740 FORWA=1TO40:POKES+8,RND
       (0)*100:NEXT:POKES+24,8
       :POKES+11,128
JA 750 POKEV+21,PEEK(V+21)AND(
       255-(2↑SP)):POKE2040+SP
       ,250:GOSUB960:RETURN
RR 760 TA=TA+1:IFTA>(3+PL*3)TH
       ENTA=1+PL*3
PF 770 IFPEEK(2040+TA)=250THEN
       GOTO760
CB 780 POKES+14,40+TA*10:RETUR
       N
HR 790 L=0
MR 800 IFPEEK(2040+TA)=250THEN
       GOSUB760:GOTO800
MS 810 POKE204,0:CC=PEEK(V+39+
       TA):POKES+20,240:POKES+
       18,65
XH 820 POKEV+39+TA,12:GETM$:PO
       KE207,0:POKEV+39+TA,CC:
       IFM$=""THEN820
SQ 830 IFASC(M$)=20ANDL>0THENP
       OKE204,1:PRINT"{OFF}V
       {3 LEFT}V{LEFT}";:M$(TA
       ,L)="X":L=L-1:GOTO810
RP 840 IFM$=" "THENGOSUB760:GO
       TO810
XQ 850 C=0:FORN=1TO5:IFM$=MID$
       ("LRMF",N,1)THENC=N+1
AS 860 NEXT:IFC=0THENGOTO810
XA 870 BR=0:IFTA>3THENBR=40
EA 880 L=L+1:POKE204,1:PRINT"
       {RVS} {RIGHT}";:M$(TA,L
       )=M$:IFL<10THEN810
SX 890 RETURN
MA 900 CL=0:FORN=1TO6:IFPEEK(2
       040+N)=250THEN940
KH 910 IFN=TATHEN940
CB 920 B1=(PEEK(V+16)AND(2↑TA)
       )/(2↑TA):B2=(PEEK(V+16)
       AND(2↑N))/(2↑N)
XA 930 IFB1=B2THENIFABS(H(TA)-
       H(N))<10ANDABS(V(TA)-V(
       N))<10THENCL=1:SP=N:GOS
       UB730
CP 940 NEXT:IFCL=0THENRETURN
DQ 950 SP=TA:GOSUB730:RETURN
RH 960 IFSP>3THEN990
FP 970 W0=2:FORN=1TO3:IFPEEK(2
       040+N)<>250THENW0=0
SJ 980 NEXT:GOTO1010
HE 990 W0=1:FORN=4TO6:IFPEEK(2
       040+N)<>250THENW0=0
JX 1000 NEXT
JC 1010 IFW0=0THENRETURN
SC 1020 POKES+24,0:POKEV+21,0:
        POKE53281,1
QD 1030 PRINT"{CLR}{8 DOWN}
        {RED}{OFF}{5 SPACES}CO
        NGRATULATIONS TANK COM
        MANDER"
AR 1040 IFW0=1THENPRINTSPC(5)P
        1$
GJ 1050 IFW0=2THENPRINTSPC(5)P
        2$
QD 1060 PRINT"{3 DOWN}
        {8 SPACES}{RVS}PRESS A
        NY KEY TO CONTINUE":PO
        KE198,0
SM 1070 GETK$:IFK$=""THEN1070
```

```
SR 1080 RETURN:DATA0,0,0,16,0,
        0,0,0,0,0,0,16,0,66,0,
        136,0,0,40,8,0,3,32,3.
        ,32
GG 1090 DATA204,128,0,202,0,2,
        32,0,2,0,0,72,136,0,10
        ,206,0,8,0,128,32,48,0
        ,0,48
HG 1100 DATA0,0,12,0,4,0
CE 1110 DATA4,0,0,0,0,0,0,255,
        0,0,0,0,0,0,0,0,0,4,0,
        0,0,2,32,8,2,128,10,73
        ,0,2,43
DC 1120 DATA0,2,220,128,6,178,
        0,2,123,0,2,236,0,10,1
        38,0,10,14,0,8,3,128,3
        3,0,0
BA 1130 DATA0,0,64,0,0,0,0,0,0
        ,0,0,0,0,0,0,255,0,0,0
        ,0,0,0,0,0,0,0,0,0,0,0
        ,0,0,0,0
FH 1140 DATA0,0,0,0,59,184,0,2
        55,255,2,167,214,2,159
        ,250,255,255,250,2,159
        ,250,2
SX 1150 DATA167,214,0,255,255,
        0,187,184,0,0,0,0,0,0,
        0,0,0,0,0,0,0,0,0,0,0,
        0,0,0,0
XS 1160 DATA0,0,0,0,0,42,0,3,1
        06,112,3,153,176,2,157
        ,160,3,127,112,3,127,1
        12,2
JD 1170 DATA127,96,3,157
QR 1180 DATA176,3,157,176,2,17
        4,160,3,174,176,3,174,
        176,0,174,128,0,12,0,0
        ,12,0,0
EC 1190 DATA12,0,0,12,0,0,12,0
        ,0,0,0,0,0,0,0,0,0,0,0
        ,0,0,0,0,0,0,0,0,0,0,0
        ,46,239
RP 1200 DATA0,255,255,0,151,21
        8,128,175,246,128,175,
        255,255,175,246,128,15
        1,218
QJ 1210 DATA128,255,255,0,46,2
        39,0,0,0,0,0,0,0,0,0,0
        ,0,0,0,0,0,0,0,0,12,0,
        0,12,0,0
GC 1220 DATA12,0,0,12,0,0,12,0
        ,0
FP 1230 DATA174,128,3,174,176,
        3,174,176,2,174,160,3,
        157,176,3,157,176,2,12
        7,96,3
FF 1240 DATA127,112,3,127,112,
        2,157,160,3,153,176,3,
        106,112,0,42
KJ 1250 DATA0,0,0,0,0,0,0,0,0,
        0,0                    G
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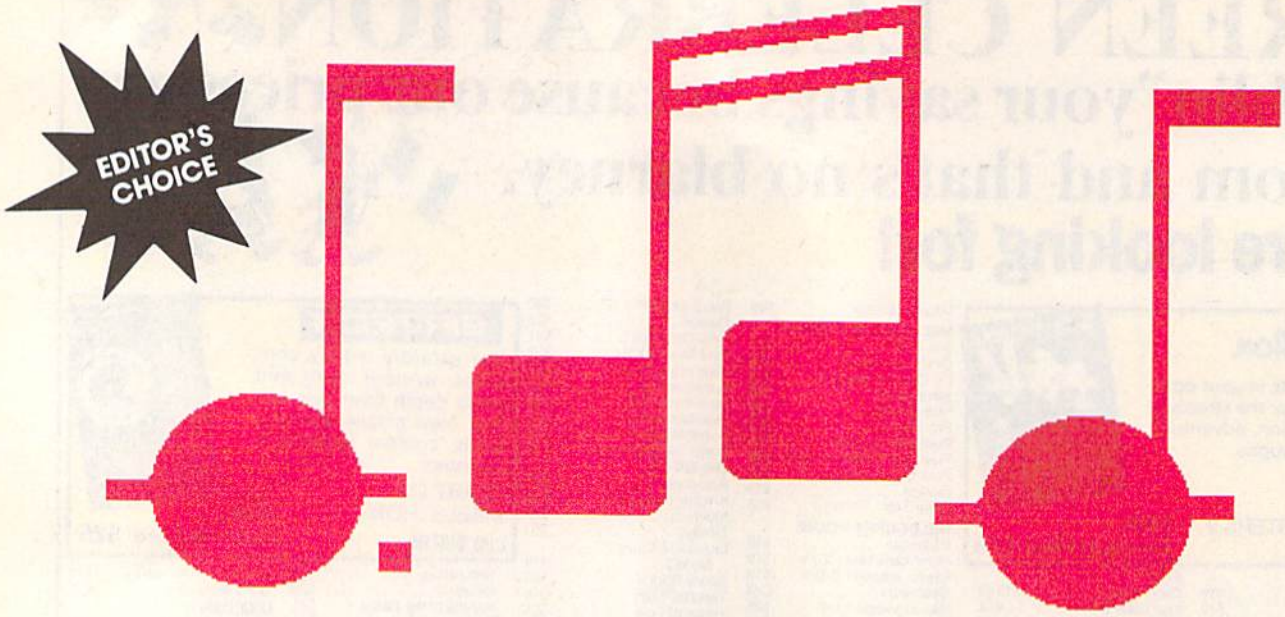

SynthPlayer

Mariusz Jakubowski

Compose a masterpiece with this powerful music-editing system for the 64. Joystick required.

SynthPlayer lets you harness the power of the SID chip—the sound chip found in every 64 and 128—and channel it into your own songs. With this versatile music editor, you can create sound effects or compose full-fledged songs. Your only limitations are your imagination and the amount of memory available for notes.

Entering and editing music is quick and easy when you use *SynthPlayer*'s intuitive joystick and keyboard controls. Often-used commands such as Copy, Play, Load, and Save are readily available through the function keys. Others can be accessed with the joystick or other keystrokes. To make fine-tuning easier, you can change most sound parameters—such as waveforms, filters, and the tempo—while your song plays. Best of all, you can save your completed songs as files that can be played in the background while your BASIC programs run.

Getting Started

SynthPlayer consists of two BASIC programs, SynthPlayer Loader and SynthPlayer Main, and one machine language file, SynthPlayer ML. To avoid typing mistakes, enter the BASIC programs using *The Automatic Proofreader*, the BASIC typing checker found elsewhere in this issue. Be sure to save both programs on the same disk. Save SynthPlayer Main with the filename SYNTH.BAS.

To enter SynthPlayer ML, you'll have to use *MLX*, the machine language entry program also found in this issue. The *MLX* prompts, and the values you should enter, are as follows:

Starting address: C000
Ending address: C7DF

Once you've finished entering the data for the program, save it to the disk that contains the two BASIC programs. Use the filename SYNTH.ML.

When you're ready to use *SynthPlayer*, load and run SynthPlayer Loader. After a short delay during which the programs are loaded and initialized, the main screen appears.

Entering and Editing

The opening screen contains two musical staffs on which you enter notes. You can enter notes within a five-octave range, including the top and bottom staffs (corresponding to the treble and bass clefs, respectively) and notes above and below the two. This arrangement allows you to enter songs directly from most modern sheet music with a minimum of trouble.

To enter a note, first use the joystick to move the flashing note pointer up or down the scale. As you move the pointer, each note in the chromatic scale is displayed. Sharps are taken care of automatically; if you want to enter a flat, you'll have to enter its sharp equivalent (for example, a B-flat is equivalent to an A-sharp). Once you've selected the correct pitch for the note, press the fire button. The border turns gray to indicate that the pitch is set.

Now you're ready to select the note's duration. Again, move the joystick up and down to choose. As you move the joystick, the duration indicator at the bottom of the screen changes to show the length of the note. The color of the note pointer on the staff also changes. *SynthPlayer* supports every note duration between 1/64th and double-whole notes, including dotted notes. When you're satisfied with your selection, click the fire button again to place it on the staff. Before you press the button to select the note's duration, you can press R to indicate that a rest

should be inserted instead of a note. The screen border turns red to indicate that you're entering a rest. Rests are displayed on the staff as square symbols.

As you continue to enter notes, the pointer advances to the end of the staff. When the pointer reaches the right edge of the screen, the staff scrolls to the left automatically. To move notes that have scrolled off the screen back into view, simply move the note pointer to the edge of the screen. Placing the pointer on the left edge of the screen scrolls the staff to the right, and placing it on the right scrolls the staff left. If you discover an incorrect note, you can change it by placing the note pointer over the incorrect note and following the procedure outlined above.

SynthPlayer allows you to work on only one voice at a time, and the active voice is displayed in the upper left corner of the screen. To change voices, press the 1, 2, or 3 key. When you do so, the note pointer moves to the end of any notes that you've already entered for that voice. You can move the pointer to the beginning of the notes for the current voice by pressing HOME. You can erase all the notes for the current voice by pressing SHIFT-HOME.

The amount of space available for storing notes always appears in the upper left corner of the screen beneath the current voice indicator. The number next to *Free* is the number of notes that may be entered before you run out of memory.

Commands

The command menu is displayed in the upper right corner of the main screen. You can execute any command when the screen border is black (as long as you're not entering a note). The following paragraphs explain each command.

f1 Play. Play the notes entered for all three voices. You can increase or decrease the tempo at which the notes are played by pressing the + or − key, respectively. When *SynthPlayer* reaches the end of your song, it pauses briefly and then plays it again. Press the fire button to stop the music at any time.

f2 Editor. Go to the sound-editor screen. We'll discuss the sound editor momentarily.

f3 Delete. Delete the note directly to the left of the note pointer and move the following notes up to fill the gap. Be careful when your pointer is at the left edge of the screen, because you won't be able to see the notes you delete.

f4 Insert. Open a space for an additional note beneath the note pointer. You must enter the pitch and duration for this note before continuing.

f5 Mark. Mark a group of notes to be copied with the Copy command. When you press f5, the border turns blue. Move the pointer to one end of the section you wish to move and press the fire button. When the border turns green, move the pointer to the other end of the section and press fire again.

f6 Copy. Copy the group of notes marked with the Mark command. When you press f6, the marked segment is copied at the location of the note pointer. Note that if you make changes to the notes after they've been marked, any copies made afterward will reflect the changes. Also, if you attempt to copy the marked notes to a location between the beginning and end of the marked section, the results will be unpredictable.

f7 Load. Load a *SynthPlayer* edit file. When you press f7, *SynthPlayer* prompts you for the name of an edit file. Enter the name of the file without the EDT extension and press RETURN. When the load is completed, the note pointer is near the end of the song.

f8 Save. Save a sound file to disk. *SynthPlayer* saves the note data from all three voices, as well as the parameters from the sound editor screen, in one of two formats. The first format, edit, creates a file that can be reloaded into *SynthPlayer* and modified. The other format, object, creates a stand-alone file that can be loaded and executed but can't be loaded into *SynthPlayer*.

When you press f8, the program prompts you for a filename. Enter up to 12 characters for the name. (You're limited to 12 characters because *SynthPlayer* adds a four-character extension.) Next, it asks you to select the save format. Press E to save the music as an edit file or O to save as an object file. Edit files have an EDT extension, while object files actually occupy two files with the extensions OBJ and SND.

The Sound Editor

When you press f2 from the main screen, you enter *SynthPlayer*'s sound editor. From the editor, you can fine-tune the default sounds for the SID chip's three voices or create new sounds.

As you enter the editor, the screen contains a summary of the SID chip's registers and their contents. The registers that control individual voices are listed in three columns (one for each voice) along the top of the screen. The registers that affect all three voices are displayed at the bottom of the screen.

The editor screen also contains a note pointer with which you can change the values in the SID registers. You can change most of the registers by moving the note pointer to the value, holding down the fire button, and moving the joystick up or down. Any exceptions to this rule are discussed in the register summary below. We assume that you're already somewhat familiar with the SID chip; we discuss its features only when it's necessary to explain how to use the sound editor. If you need more information about the SID chip, the *Commodore 64 Programmer's Reference Guide*, from Bantam Books, and *Mapping the 64 and 64C* and *All About the Commodore 64, Volume Two*, from COMPUTE! Books are excellent references.

The first group of control registers affect individual voices.

Pulse. Sets the pulse width or duty cycle of the pulse waveform. This register can hold a value ranging from 0 to 4096. Changing the setting to a value near the center of the range results in a deeper, richer tone. Values near the ends of the range result in a tinny sound. If the value seems to change randomly when you try to set it, the SWEEP option is active. You can use the f7 key to fine-tune the setting if you can't get the exact value you want with the joystick.

Wave. Selects one of the SID chip's four waveforms: triangle, sawtooth, pulse, or noise.

Ring. Toggles ring modulation on or off. Ring modulation works only with the triangle waveform, and it replaces the triangle wave from two voices with a synthesized combination of the two. Voices 1 and 2, 1 and 3, or 2 and 3 can be combined in this manner. Ring modulation is usually used to create bell or gong sounds.

Sync. Toggles synchronization on or off. The waveforms of two notes that are an octave (12 half-steps) apart are naturally synchronized because the frequency of the higher note is exactly double that of the lower note. The SID chip's synchronization register allows you to force two waveforms to synchronize no matter what the difference in the frequencies. As with ring modulation, voices 1 and 3, 1 and 2, or 2 and 3 can be synchronized.

Attack, Decay, Sust, and Rel. Control the sound envelope for the voice. Each value can range from 0 to 15. Attack controls the amount of time taken to rise from zero volume to maximum volume, and decay controls the time taken to fall from maximum volume to sustain volume. Sustain is the volume level at which the sound plays until it's turned off. Release is the amount of time required for the sound to fall from sustain volume to zero volume after the sound is turned off.

Sweep. Not a feature of the SID chip, Sweep is an effect generated by *SynthPlayer*. It changes the pulse width of the pulse wave at the rate determined by the sweep setting. The result is a rich, animated sound. If sweep is turned on, it can have values of 0–255. This option constantly changes the pulse width, so changing it manually has little effect. ▷

Vibr. Another feature of *SynthPlayer*, Vibr controls the degree of vibrato (a rapid fluctuation in frequency) that the program applies to the sound. Vibrato is generally used to enrich an otherwise plain sound.

The next group of control registers affect all three voices.

Cutoff Freq. Sets the cutoff frequency for the SID chip's filters. The value can range from 0 to 2047, and its effect varies with the type of filter selected.

Resonance. Selects how much frequencies near the cutoff are attenuated or sharpened. Legal values for this register are 0–15.

Voices. Determines which voices are to be passed through the filter. To change voices, move the note pointer next to the value and then press f1 to toggle voice 1, f3 to toggle voice 2, and f3 to toggle voice 3.

Mode. Sets the filter type to be applied to the selected voices. The SID chip supports three types of filters: low-pass (full-bodied sounds), bandpass (thin, open sounds), or high-pass (tinny, buzzy sounds). You can use these filters individually or in combination. To change the filters, press f1 to toggle the low-pass filter, f3 to toggle bandpass, or f5 to toggle high-pass.

Volume. This is the overall volume level for all three voices. This value ranges from 0 to 15. (Some SID chips tend to clip at full volume, so you may need to reduce this value to produce a clear tone.)

You don't have to be familiar with all of the SID chip's options to be able to use them. Just experiment. You may stumble onto something that you like. Also, remember that you can use the sound editor to change sound parameters while your song plays.

When you're ready to return to the main screen, press the space bar.

For Programmers

SynthPlayer stores the music data in the RAM under BASIC ROM so that no memory is taken away from BASIC. If, however, your song is too long (more than 2700 notes), it won't fit in 8K of RAM. You can make room for longer songs by moving BASIC's top-of-memory pointer. For example, typing

```
POKE 55,0:POKE 56,152:POKE 152*256,0
:NEW
```

would give you an extra 2K for notes. It would also reduce BASIC program space by about 2K.

You can load and play object sound files without having *SynthPlayer* in memory. To do so, you must load the ML portion of *SynthPlayer* along with the sound files. For example, if you saved a song as an object file with the filename ETUDE, you could play it with the following commands:

```
LOAD"SYNTH.ML",8,1
NEW
LOAD"ETUDE.OBJ",8,1
NEW
LOAD"ETUDE.SND",8,1
NEW
SYS 49152
```

Be sure to load the files in the order shown above and type NEW after each load. You can stop the music by typing SYS 50424.

As your song plays, you can control a variety of effects with POKE commands. *SynthPlayer* maintains shadow registers of the SID chip's registers at locations 50320–50344, so you must make changes in these shadow registers for them to take effect. The accompanying table contains other locations that you may want to modify.

SynthPlayer Playback Registers

Location	Effect
50320–50344	SID-chip shadow registers
50991–50993	Sweep rate for voices 1–3
50994–50996	Vibrato for voices 1–3
56501	Tempo (default value is 66)

SynthPlayer Loader

```
HQ 10 REM COPYRIGHT 1990 COMPU
      TE! PUBLICATIONS, INC. -
       ALL RIGHTS RESERVED
RA 20 POKE53280,0:POKE53281,0:
      PRINT"{CLR}{6}":FORI=1TO
      9:PRINT"{DOWN}":NEXTI
MX 30 PRINTTAB(13)"COPYRIGHT 1
      990{DOWN}":PRINTTAB(6)"C
      OMPUTE! PUBLICATIONS, IN
      C.{DOWN}"
AA 40 PRINTTAB(10)"ALL RIGHTS
      {SPACE}RESERVED"
CP 50 PRINT"{HOME}{GRN}LOADING
       ML...{BLK}"
RG 60 IFF=0THENF=1:LOAD"SYNTH.
      ML",8,1
HF 70 PRINT "{BLK}REM{GRN}LOAD
      ING BASIC...{BLK}"
FG 80 PRINT"{2 DOWN}{BLK}POKE4
      3,200:POKE44,8:POKE55,0:
      POKE56,96:POKE2247,0:NEW
      "
MH 90 PRINT"{2 DOWN}LOAD"+CHR$
      (34)+"SYNTH.BAS"+CHR$(34
      )+",8"
XC 100 PRINT"{4 DOWN}RUN{HOME}
       ":FORF=631TO640:POKEF,1
       3:NEXT:POKE198,10
```

SynthPlayer Main

```
HQ 10 REM COPYRIGHT 1990 COMPU
      TE! PUBLICATIONS, INC. -
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AJ 20 IFLFTHEN2350
MG 30 PRINTCHR$(14)"{GRN}{CLR}
      A FEW MOMENTS PLEASE..."
CA 40 A1=24600:A2=30053:A3=355
      06:SI=3271:ES=254:VL=545
      3:BO=53280:MR=50931:ML=5
      0949
EH 50 DIM NH(255),NL(255),SP(2
      00),SF(200),DR(15),DR$(1
      5),CL(15),DT(15),DL(32)
JG 60 AD=A1+4:BE=AD:SA=BE+SI:B
      S=SA:PT=2040:J=56320:O=-
      1:NS=1:DOT=0:DP=1045:MA=
      1080
QP 70 PS=51024:SP=51057:SV=510
      63:SC=51078:FS=51086:BB=
      50424:LD=51159
FB 80 F=902:P=197:M=2↑(1/12):C
      O=1:CS=0:SD=0:TD=50598:F
      D=50595:NB=53232:MD=5057
      2
AA 90 TU=50523:FU=50520:MU=504
      66:ID=56501:IT=66:POKEID
      ,IT:POKE650,128:AB=A1+4
KJ 100 XR=782:YR=781:PR=65520
JB 110 WF$(1)=" TRI ":WF$(2)="
       SAW ":WF$(4)=" PULS":W
      F$(8)=" NOIS"
ER 120 S1$="{28 SPACES}":SP$="
      {2 SPACES}":M$="
      {6 SPACES}"
DF 130 FL=851:PF=845:FORI=0TO2
      :A=BE+I*VL-4:POKEA,1:PO
      KEA+1,1:POKEA+2,32
XH 140 POKEA+2,32:POKEA+3,30:P
      OKEA+4,ES:IFI=1THENPOKE
      A+2,0:POKEA,0
GM 150 NEXT
DR 160 FORN=1TO60
QB 170 H=INT(F/256):L=F-256*H
AC 180 NH(N)=H:NL(N)=L:SF(N)=1
      1
HS 190 IFO=11THENO=-1
FB 200 F=F*M:P=P-4
BC 210 O=O+1:IFO=1ORO=4ORO=6OR
      O=9ORO=11THENP=P+4:SF(N
      )=13
BQ 220 SP(N)=P:NEXT
RH 230 SP(0)=132:SF(0)=32:N=0
GS 240 FORI=1TO15:READDR(I),DR
      $(I),CL(I),DT(I):NEXT:C
      D=7
QP 250 DATA1,1 / 64,4,0,2,"1 /
       64 {F}",4,1,3,1 / 32,2
      ,0,5,"1 / 32 {F}",2,1
QG 260 DATA7,1 / 16,6,0,11,"1
      {SPACE}/ 16 {F}",6,1,15
      ,1 / 8,9,0,23,"1 / 8
      {F}",9,1
EB 270 DATA31,1 / 4,5,0,47,"1
      {SPACE}/ 4 {F}",5,1,63,
      1 / 2,14,0,95,"1 / 2
      {F}",14,1
AB 280 DATA127,WHOLE,3,0,191,"
      WHOLE {F}",3,1,255,DOUB
      LE,12,0
HJ 290 DL(11)=14:DL(13)=15:DL(
      14)=14:DL(15)=15:DL(32)
      =32
MJ 300 SYS50345:SYS49152:SYS50
      424
SM 310 VS=49146:POKEVS,24:POKE
      VS+1,96:POKEVS+2,101:PO
      KEVS+3,117
AB 320 POKEVS+4,178:POKEVS+5,1
      38
KE 330 V=53248:X=20:PP=32:Y=0
FG 340 FORS=3TO15STEP2
EH 350 POKEV+S-1,X+(S-2)*12:PO
      KEV+S,Y
CC 360 NEXT:POKEPT,11:POKEV+1,
      192:POKEV,PP:POKEV+28,0
DC 370 NC=0:UP=126:DOWN=125:LE
      FT=123:RIGHT=119:O=0:BU
      =110:BD=109:S=50320
XS 380 POKES+4,PEEK(S+4)AND254
      :POKES+11,PEEK(S+11)AND
      254:POKES+18,PEEK(S+18)
      AND254
RA 390 VC=1:GOSUB2140:SYSFS:PO
      KEV+21,255
XK 400 :
BJ 410 A=PEEK(J):GETK$:IFK$=""
      THEN500
```

```
HE 420 K=ASC(K$):K1=K-132
FD 430 K2=VAL(K$):IFK2>0THENIF
       K2<4THEN ON K2 GOSUB107
       0,1090,1110:GOTO410
FD 440 IFK1>8ORK1<1THEN460
HB 450 ON K1 GOSUB940,1640,456
       0,2300,2800,1710,4710,2
       510:GOTO410
JH 460 IFK$="+" THENIFIT>21THE
       NIT=IT-1:POKEID,IT:GOSU
       B600:GETK$:IFK$="+"THEN
       460
DB 470 IFK$="-" THENIFIT<200TH
       ENIT=IT+1:POKEID,IT:GOS
       UB600:GETK$:IFK$="-"THE
       N470
CB 480 IFK$="{HOME}"THENGOSUB5
       130:GOTO410
QD 490 IFK$="{CLR}"THENGOSUB51
       40:GOTO410
XG 500 IFA=127THEN410
CK 510 IF(AAND16)=0THENGOSUB62
       0:GOTO410
XK 520 IF A<>DOWN THEN560
PQ 530 IFCO>1THENCO=CO-1
XA 540 POKEV+1,SP(CO):A=SF(CO)
       :IFDT(CD)THENA=DL(A)
BJ 550 POKEPT,A:GOTO410
CJ 560 IF A<>UP THEN1240
DR 570 IFCO<60THENCO=CO+1
XD 580 POKEV+1,SP(CO):A=SF(CO)
       :IFDT(CD)THENA=DL(A)
BR 590 POKEPT,A:GOTO410
KP 600 POKEV+21,255:X=35:Y=1:V
       A=201-IT:A$="{6}"+STR$(
       VA)+SP$:GOSUB2110
PQ 610 RETURN
JS 620 POKEBO,11
RF 630 IFNC>=MAANDAD=BE+NC*3TH
       ENPOKEBO,0:GOTO930
PH 640 WAITJ,16
SH 650 RE=0:IFNTHENCD=N
EC 660 POKEAD+1,NL(CO):POKEAD+
       2,NH(CO):POKESA,CO:SYSB
       B
RQ 670 A=PEEK(J):GETK$
FG 680 IF(AAND16)<>0THEN720
PS 690 C=CO
GB 700 IFRETHENPOKEAD+1,0:POKE
       AD+2,0:POKESA,0:C=0
BM 710 POKEAD,DR(CD):POKESA+1,
       CD:GOTO800
EC 720 IFA=DOWNTHENIFCD>1THENC
       D=CD-1
PJ 730 IFA=UPTHENIFCD<15THENCD
       =CD+1
SD 740 IFK$="R"THENRE=1:POKEBO
       ,2
AJ 750 X=9:Y=22:A$=DR$(CD)
AF 760 A$=A$+M$:GOSUB2110
KP 770 POKEV+39,CL(CD):A=SF(CO
       ):IFDT(CD)THENA=DL(A)
SP 780 POKEPT,A
GJ 790 GOTO670
GG 800 IFLP<>7THEN820
FE 810 POKEV+NS*2,200:SYSML
MA 820 POKEV+NS*2+1,SP(C):POKE
       PT+NS,SF(C)
JG 830 IFDT(CD)ANDNOTRETHENL=P
       T+NS:POKEL,DL(PEEK(L))
SG 840 L=V+39+NS:A=CL(CD)
PH 850 POKEL,A
XD 860 IFLP=6ANDAD<BE+3*NCTHEN
       RF=1:GOSUB1250:N=CD:RF=
       0:POKEBO,0:SYSFS:GOTO92
       0
HJ 870 NS=NS+1:IFNS=8THENNS=1
XE 880 IFPP<200THENPP=PP+24
KJ 890 POKEV,PP:POKEBO,0
DH 900 N=CD:IFAD=BE+3*NCTHENNC
       =NC+1
BS 910 SYSFS:SA=SA+2:AD=AD+3:I
       FLP<7THENLP=LP+1
DC 920 X=6:Y=3:A$=STR$(MA-NC)+
       SP$+SP$:GOSUB2110:IFNRT
       HENNR=0:GOTO410
MB 930 RETURN
PJ 940 POKEBE+3*NC,ES:POKEBO,5
       :RF=1
SG 950 T=VC:FORVC=1TO3:GOSUB51
       90:NEXT:VC=T
GA 960 SYS49152
XX 970 A=PEEK(J):GETK$:RF=1:GO
       SUB1240:RF=0
RJ 980 IFK$="{F2}"THENGOSUB280
       0
FK 990 IFK$="+"THENIFIT>21THEN
       IT=IT-1:POKEID,IT:GOSUB
       600:GETK$:IFK$="+"THEN9
       90
RR 1000 IFK$="-"THENIFIT<200TH
       ENIT=IT+1:POKEID,IT:GO
       SUB600:GETK$:IFK$="-"T
       HEN1000
BG 1010 K2=VAL(K$):IFK2>0THENI
       FK2<4THEN ON K2 GOSUB1
       070,1090,1110
EA 1020 A=PEEK(J):IF(AAND16)=0
       THEN1040
QD 1030 GOTO970
FG 1040 SYSBB:SYSFS
RQ 1050 WAITJ,16:POKEBO,0
FC 1060 RETURN
QR 1070 NT(VC)=NC:POKEBE+3*NC,
       ES:VC=1:AD=A1+4:SA=AD+
       SI
RC 1080 GOTO1120
FA 1090 NT(VC)=NC:POKEBE+3*NC,
       ES:VC=2:AD=A2+4:SA=AD+
       SI
XC 1100 GOTO1120
PQ 1110 NT(VC)=NC:POKEBE+3*NC,
       ES:VC=3:AD=A3+4:SA=AD+
       SI
QX 1120 X=6:Y=1:A$=STR$(VC)
EJ 1130 GOSUB2110
CS 1140 NC=NT(VC):BE=AD:BS=SA
BX 1150 AD=AD+NT(VC)*3:SA=SA+N
       T(VC)*2
KA 1160 T=AD-BE:IFT>18THENAD=A
       D-21:SA=SA-14:GOTO1180
GC 1170 AD=BE:SA=BS
RA 1180 LP=0:GOSUB1900
CS 1190 PP=32:POKEV,PP
KS 1200 X=9:Y=22:IFNC>0THENCD=
       PEEK(SA+1):N=CD:A$=DR$
       (CD)+M$:GOTO1220
SD 1210 A$=DR$(CD)+M$
XS 1220 GOSUB2110
GR 1230 GOTO920
RB 1240 IFA<>RIGHTTHEN1460
GJ 1250 MV=BE+NC*3
EF 1260 IFAD=MVTHEN1440
JX 1270 IFLP>=6THEN1300
GM 1280 LP=LP+1:PP=PP+24:N=PEE
       K(SA+3):IFAD=MV-3THENN
       =CD
CG 1290 GOTO1390
AC 1300 IFLP=6ANDAD=MV-3THENLP
       =LP+1:PP=PP+24:N=CD:GO
       TO1390
RK 1310 SA=SA+2:NS=NS+1:IFNS=8
       THENNS=1
GX 1320 SYSML:POKEV+NS*2,176:V
       A=PEEK(SA)
QE 1330 POKEV+NS*2+1,SP(VA):N=
       PEEK(SA+1)
CX 1340 L=PT+NS:A=SF(VA):IFDT(
       N)THENA=DL(A)
QB 1350 POKEL,A
KK 1360 L=V+39+NS:A=CL(N)
CD 1370 POKEL,A
CG 1380 GOTO1400
FA 1390 SA=SA+2:NS=NS+1:IFNS=8
       THENNS=1
AC 1400 AD=AD+3
ED 1410 A$=DR$(N)+M$:X=9:Y=22:
       GOSUB2110
DB 1420 POKEV,PP
SK 1430 A=PEEK(J):IFA<>127THEN
       1240
KM 1440 IFRFTHENRETURN
EG 1450 GOTO410
FK 1460 IFA<>LEFTTHEN1620
MD 1470 IFAD=BETHEN1620
GE 1480 NS=NS-1:IFNS=0THENNS=7
PK 1490 AD=AD-3:SA=SA-2:N=PEEK
       (SA+1)
EK 1500 A$=DR$(N)+M$:X=9:Y=22:
       GOSUB2110
XG 1510 IFLP>0THENLP=LP-1:PP=P
       P-24:GOTO1600
GD 1520 SYSMR
MF 1530 POKEV+NS*2,32
RK 1540 VA=PEEK(SA)
KH 1550 POKEV+NS*2+1,SP(VA)
PS 1560 L=PT+NS:A=SF(VA):IFDT(
       N)THENA=DL(A)
GS 1570 POKE L,A
GP 1580 L=V+39+NS:A=CL(N)
RB 1590 POKEL,A
BM 1600 POKEV,PP
PS 1610 A=PEEK(J):IFA<>127THEN
       1240
MH 1620 IFRFTHENRETURN
FD 1630 GOTO410
MJ 1640 :
KJ 1650 IFAD=BETHENRETURN
SF 1660 IFLP>0THEN LP=LP-1:PP=
       PP-24
SC 1670 IFAD=BE+NC*3THENAD=AD-
       3:SA=SA-2:POKESA+1,CD:
       GOTO1700
DF 1680 F=AD:AD=AD-3:T=AD:L=BE
       +NC*3-AD:GOSUB2020
BE 1690 F=SA:SA=SA-2:T=SA:L=BS
       +NC*2-SA:GOSUB2020
CH 1700 NC=NC-1:POKEV,PP:GOTO1
       900
FK 1710 IFAD=BE+NC*3ORLP=7ORNC
       >=MATHEN1890
QX 1720 FORI=LPTO6
EH 1730 L=V+NS*2:POKEL,PEEK(L)
       +24
FG 1740 NS=NS+1:IFNS=8THENNS=1
BB 1750 NEXT
CQ 1760 F=AD:T=AD+3:L=BE+NC*3-
       AD
MC 1770 GOSUB2020
RD 1780 F=SA:T=SA+2:L=BS+NC*2-
       SA
QE 1790 GOSUB2020
GB 1800 A=PEEK(J):IFA=127THEN1
       800
MD 1810 IFA=UPTHENIFCO<60THENC
       O=CO+1
MG 1820 IFA=DOWNTHENIFCO>1THEN
       CO=CO-1
MP 1830 POKEV+1,SP(CO):POKEPT,
       SF(CO)
SB 1840 IF(AAND16)=0THENGOSUB6
       20:GOTO1860
RG 1850 GOTO1800
KH 1860 IFLP=7THENLP=6:PP=PP-2
       4:POKEV,PP
DA 1870 NC=NC+1:GOSUB1900
MA 1880 NS=LP+1:IFNS=8THENNS=1
XK 1890 RETURN
BQ 1900 T1=SA:T2=LP:SA=SA-2*LP
       :C=BS+2*NC:X=32
QJ 1910 FORNS=1TO7
FH 1920 IFSA>=CTHENPOKESV+NS*2
       +1,0:N=CD:GOTO1980
FK 1930 VA=PEEK(SA):N=PEEK(SA+
       1):POKESV+NS*2+1,SP(VA
       )
HA 1940 L=SC+NS:A=CL(N)
GH 1950 POKEL,A
FG 1960 L=SP+NS:A=SF(VA):IFDT(
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N)THENA=DL(A)
DS 1970 POKEL,A:SA=SA+2
RJ 1980 POKESV+NS*2,X:X=X+24
SP 1990 NEXT:SYSPS
DG 2000 SA=T1:LP=T2:NS=LP+1:IF
        NS=8THENNS=0
EM 2010 GOTO1200
CK 2020 HF=INT(F/256):LF=F-256
        *HF
EK 2030 HT=INT(T/256):LT=T-256
        *HT
XE 2040 LH=INT(L/256):LL=L-256
        *LH
PX 2050 POKENB,LL:POKENB+1,LH
AJ 2060 IFF<TTHEN2090
KK 2070 POKEFD,LF:POKEFD+1,HF:
        POKETD,LT:POKETD+1,HT:
        SYSMD
QC 2080 RETURN
MA 2090 POKEFU,LF:POKEFU+1,HF:
        POKETU,LT:POKETU+1,HT:
        SYSMU
MC 2100 RETURN
BA 2110 POKE783,0:POKEXR,X:POK
        EYR,Y:SYSPR
AX 2120 PRINT A$;
BE 2130 RETURN
DS 2140 POKEBO,0:POKEBO+1,0
BD 2150 PRINT"{GRN}{CLR}":SYS5
        0640
QX 2160 PRINT "{HOME}"SPC(14)"
        {RVS}{7} SYNTHPLAYER "
FA 2170 VA=201-IT
FH 2180 PRINT"{OFF}{7}VOICE{6}
         "STR$(VC)"{22 SPACES}
        {5}TEMPO{6}"STR$(VA)
FG 2190 PRINT"{DOWN}{7}FREE
        {2 SPACES}{6}"STR$(MA-
        NC)
JR 2200 X=28:Y=3:A$="{3}F1{2}
        {SPACE}- PLAY":GOSUB21
        10
GS 2210 Y=4:A$="{3}F2{2} - EDI
        TOR":GOSUB2110
EC 2220 Y=5:A$="{3}F3{2} - DEL
        ETE":GOSUB2110
SH 2230 Y=6:A$="{3}F4{2} - INS
        ERT":GOSUB2110
DR 2240 Y=7:A$="{3}F5{2} - MAR
        K":GOSUB2110
CM 2250 Y=8:A$="{3}F6{2} - COP
        Y":GOSUB2110
DB 2260 Y=9:A$="{3}F7{2} - LOA
        D":GOSUB2110
HH 2270 Y=10:A$="{3}F8{2} - SA
        VE":GOSUB2110
KX 2280 Y=22:X=0:A$="{5}DURATI
        ON "+"{6}"+DR$(CD):GOS
        UB2110
EB 2290 RETURN
AS 2300 SYSBB:IT=66:POKEID,IT:
        X=0:Y=20:A$="{GRN}LOAD
        : FILENAME":GOSUB2110:
        F$="":K$=F$
QM 2310 POKEV+21,0:INPUTF$:IFL
        EN(F$)>12THEN2300
DR 2320 PRINT"{6}":IFLEN(F$)=0
        THENA$=S1$+SP$:GOSUB21
        10:SYSFS:GOTO600
GR 2330 GOSUB5210:IFETHENF$=""
        :GOTO2540
QH 2340 LF=1:LOADF$+".EDT",8,1
BG 2350 LF=0
MX 2360 SL=A1-2
SX 2370 T=50320:F=PEEK(SL)+256
        *PEEK(SL+1):L=24:GOSUB
        2020:SL=SL-2
XQ 2380 T=A3+SI+4:GOSUB2480:NT
        (3)=L/2:IFL>0THENGOSUB
        2020
EQ 2390 T=A3:GOSUB2480:GOSUB20
        20
KS 2400 T=A2+SI+4:GOSUB2480:NT
        (2)=L/2:IFL>0THENGOSUB
        2020
CX 2410 T=A2:GOSUB2480:GOSUB20
        20
XB 2420 T=A1+SI+4:GOSUB2480:NT
        (1)=L/2:IFL>0THENGOSUB
        2020
HJ 2430 NC=NT(VC):ON VC GOSUB1
        070,1090,1110
PD 2440 POKEA1+4+NT(1)*3,ES:PO
        KEA2+4+NT(2)*3,ES:POKE
        A3+4+NT(3)*3,ES
BX 2450 X=0:Y=20:A$=S1$:GOSUB2
        110:SYSFS:GOSUB600
QQ 2460 IFRFTHEN920
FF 2470 NR=1:GOTO920
PE 2480 L=PEEK(SL)+256*PEEK(SL
        +1):SL=SL-2
EF 2490 F=PEEK(SL)+256*PEEK(SL
        +1):SL=SL-2
DR 2500 RETURN
GE 2510 POKEV+21,0:SYSBB:IT=66
        :POKEID,IT:X=0:Y=20:A$
        ="{GRN}SAVE: FILENAME"
        :GOSUB2110
DA 2520 NT(VC)=NC:F$=""
QK 2530 INPUTF$:IFLEN(F$)>12TH
        EN2510
RS 2540 IFLEN(F$)=0THENA$=S1$+
        SP$:GOSUB2110:SYSFS:GO
        TO600
MX 2550 PRINT"FORMAT: {RVS}E
        {OFF}DIT FILE OR {RVS}
        O{OFF}BJECT FILE{6}"
FH 2560 GETK$:IFK$="E"THEN2590
JM 2570 IFK$="O"THEN4800
DG 2580 GOTO2560
FH 2590 GOSUB5210:IFETHEN5100
BA 2600 SL=A1-22:F=A1+SI+4:T=A
        1+4+NT(1)*3
PE 2610 L=NT(1)*2:GOSUB2770:IF
        L>0THENGOSUB2020
XM 2620 F=A2:T=T+L
XD 2630 L=NT(2)*3+4:GOSUB2770:
        IFL>0THENGOSUB2020
GC 2640 F=A2+SI+4:T=T+L
KA 2650 L=NT(2)*2:GOSUB2770:IF
        L>0THENGOSUB2020
DS 2660 F=A3:T=T+L
KH 2670 L=NT(3)*3+4:GOSUB2770:
        IFL>0THENGOSUB2020
CG 2680 F=A3+SI+4:T=T+L
QQ 2690 L=NT(3)*2:GOSUB2770:IF
        L>0THENGOSUB2020
PD 2700 F=50320:T=T+L:L=25:GOS
        UB2020
QF 2710 HI=INT(T/256):LO=T-256
        *HI:POKESL,LO:POKESL+1
        ,HI
SB 2720 SYS50873,F$+".EDT",8,A
        1-22,T+L+2
SH 2730 RF=1:GOSUB2360:RF=0
CP 2740 X=0:Y=20:A$=S1$:GOSUB2
        110:Y=Y+1
GS 2750 A$=S1$+SP$+SP$+SP$:GOS
        UB2110
GS 2760 SYSFS:GOTO600
HB 2770 HI=INT(T/256):LO=T-256
        *HI:POKE SL,LO:SL=SL+1
        :POKE SL,HI:SL=SL+1
DB 2780 HI=INT(L/256):LO=L-256
        *HI:POKE SL,LO:SL=SL+1
        :POKE SL,HI:SL=SL+1
AB 2790 RETURN
ES 2800 POKEV+21,0:S=50320
EP 2810 PRINT"{CLR}"TAB(13)"
        {7}SOUND EDITOR"
AX 2820 PRINTTAB(13)"{12 T}"
QR 2830 PRINT"{CYN}{2 SPACES}V
        OICE 1{6 SPACES}VOICE
        {SPACE}2{6 SPACES}VOIC
        E 3{7}":FORI=1TO37:PRI
        NT"{T}";:NEXT
PM 2840 PRINT:PRINT"{GRN}PULSE
        {8 SPACES}PULSE
        {8 SPACES}PULSE"
HA 2850 PRINT "WAVE{9 SPACES}W
        AVE{9 SPACES}WAVE"
AK 2860 PRINT "{BLU}RING
        {9 SPACES}RING
        {9 SPACES}RING"
CB 2870 PRINT "SYNC{9 SPACES}S
        YNC{9 SPACES}SYNC"
CC 2880 PRINT "{7}ATTACK
        {7 SPACES}ATTACK
        {7 SPACES}ATTACK"
EG 2890 PRINT "DECAY{8 SPACES}
        DECAY{8 SPACES}DECAY"
GR 2900 PRINT "SUST{9 SPACES}S
        UST{9 SPACES}SUST"
JF 2910 PRINT "REL{10 SPACES}R
        EL{10 SPACES}REL"
JX 2920 PRINT "{2}SWEEP
        {8 SPACES}SWEEP
        {8 SPACES}SWEEP"
GE 2930 PRINT "VIBR{9 SPACES}V
        IBR{9 SPACES}VIBR
        {DOWN}"
HQ 2940 PRINT"{CYN}FILTER":PRI
        NT"{7}{6 T}"
KH 2950 PRINT"{RED}CUTOFF FREQ
        "
CC 2960 PRINT "RESONANCE"
QC 2970 PRINT "VOICES"
ED 2980 PRINT "MODE"
KC 2990 PRINT "{3}VOLUME{8}"
BR 3000 X=6:Y=4
GG 3010 FOR I=0 TO 2
SE 3020 A=PEEK(S+2)+256*PEEK(S
        +3):A$=STR$(A):GOSUB21
        10:Y=Y+1
KQ 3030 A=INT(PEEK(S+4)/16):A$
        =WF$(A):GOSUB2110:Y=Y+
        1
HH 3040 A=PEEK(S+4) AND 4:A$="
         OFF":IF A THEN A$=" O
        N"
BR 3050 GOSUB2110:Y=Y+1
DE 3060 A=PEEK(S+4) AND 2:A$="
         OFF":IF A THEN A$=" O
        N "
JD 3070 GOSUB2110:Y=Y+1
SF 3080 A$=STR$(INT(PEEK(S+5)/
        16)):GOSUB2110:Y=Y+1
HJ 3090 A$=STR$(PEEK(S+5) AND
        {SPACE}15):GOSUB2110:Y
        =Y+1
EG 3100 A$=STR$(INT(PEEK(S+6)/
        16)):GOSUB2110:Y=Y+1
KH 3110 A$=STR$(PEEK(S+6) AND
        {SPACE}15):GOSUB2110:Y
        =Y+1
JE 3120 A=AB+I*VL-4:IFPEEK(A)=
        0THENA$=" OFF":GOSUB21
        10:GOTO3140
PS 3130 A$=STR$(PEEK(A+2)):GOS
        UB2110
PD 3140 Y=Y+1:A=A+1:IFPEEK(A)=
        0THENA$=" OFF":GOSUB21
        10:GOTO3160
BA 3150 A$=STR$(PEEK(A+2)):GOS
        UB2110
GA 3160 Y=4:X=X+13:S=S+7
SK 3170 NEXT
HE 3180 X=11:Y=17:S=50320
FF 3190 A=PEEK(S+21)+8*PEEK(S+
        22):A$=STR$(A):GOSUB21
        10:Y=Y+1
PG 3200 A$=STR$(INT(PEEK(S+23)
        /16)):GOSUB2110:Y=Y+1
PH 3210 A=PEEK(S+23) AND 15:A$
        =""
EQ 3220 IF A AND 1 THENA$=" 1"
AX 3230 IF A AND 2 THENA$=A$+"
         2"
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PJ 3240 IF A AND 4 THENA$=A$+"
        3"
HD 3250 IF A AND 8 THENA$=A$+"
        EXTERNAL"
FE 3260 IF A=0 THENA$=" NONE"
HH 3270 GOSUB2110:Y=Y+1:IFRFTH
        EN Y=Y-1:RETURN
FG 3280 A=INT(PEEK(S+24)/16):A
        $=""
DG 3290 IF A AND 1 THENA$=" LO
        W-PASS"
SC 3300 IF A AND 2 THENA$=A$+"
        BANDPASS"
QJ 3310 IF A AND 4 THENA$=A$+"
        HIGH-PASS"
DH 3320 IF A=0 THENA$=" NONE"
FC 3330 GOSUB2110:Y=Y+1:IFRFTH
        ENY=Y-1:RETURN
AJ 3340 A$=STR$(PEEK(S+24) AND
        15):GOSUB2110
HF 3350 XP=112:YP=68:X=6:Y=4:R
        C=1:POKEV+21,1:VN=0
HG 3360 POKEV+1,YP:XL=XP:XH=XP
        AND 256:POKEV+16,0:IF
        XH THEN POKE V+16,1:X
        L=XP-256
XQ 3370 POKE V,XL:POKE V+1,YP
HD 3380 A=PEEK(J):GET K$:IF K$
        <>" " THEN3400
CR 3390 GOSUB2150:POKEV,PP:POK
        EV+1,SP(CO):POKEV+21,2
        55:POKEV+16,0:RETURN
AQ 3400 IF (A AND 16)<>0 THEN
        {SPACE}IF K$= "" THEN3
        430
CM 3410 IF RC<8 THEN ON RC GOS
        UB3580,3670,3750,3790,
        3830,3910,3990:GOTO338
        0
RA 3420 ON RC-7 GOSUB4020,4050
        ,4130,4160,4250,4330,4
        430,4530:GOTO3380
KD 3430 IFA<>UP THEN3470
FR 3440 IFRC=1 THEN3380
MA 3450 IFRC=11 THEN XP=112+VN
        *104:X=6+13*VN:RC=RC-1
        :Y=Y-4:YP=YP-32:GOTO33
        60
PP 3460 RC=RC-1:Y=Y-1:YP=YP-8:
        GOTO3360
MG 3470 IF A<>DOWN THEN3510
AG 3480 IF RC=15 THEN3380
FH 3490 IF RC=10 THEN XP=186:X
        =11:RC=RC+1:Y=Y+4:YP=Y
        P+32:GOTO3360
AH 3500 RC=RC+1:Y=Y+1:YP=YP+8:
        GOTO3360
PA 3510 IF A<>RIGHT THEN3540
FR 3520 IF VN=2 OR RC>10 THEN3
        380
MD 3530 VN=VN+1:XP=XP+104:X=X+
        13:GOTO3360
FH 3540 IF A<>LEFT THEN3570
AQ 3550 IF VN=0 OR RC>10 THEN3
        380
JM 3560 VN=VN-1:XP=XP-104:X=X-
        13:GOTO3360
GE 3570 GOTO3380
CQ 3580 L=S+VN*7+2
JJ 3590 Q=PEEK(L)+256*PEEK(L+1
        )
QA 3600 IF A=BU THEN IF Q<4076
        THEN Q=Q+20
BF 3610 IF A=BD THEN IF Q>20 T
        HEN Q=Q-20
GS 3620 IF K$="{F7}" THEN IF Q
        <4095 THEN Q=Q+1
KH 3630 HI=INT(Q/256):LO=Q-256
        *HI:POKE L,LO:POKE L+1
        ,HI
XQ 3640 A$=STR$(Q)+SP$:GOSUB21
        10
JX 3650 A=PEEK(J):IF (A AND 16
        ) <> 0 THEN RETURN
SX 3660 GOTO3590
FE 3670 L=S+VN*7+4:Q=INT(PEEK(
        L)/16)
RJ 3680 POKE L,PEEK(L) AND 15
AR 3690 IF A=BU THEN Q=Q*2:IF
        {SPACE}Q=16 THEN Q=1
MS 3700 IF A=BD THEN Q=Q/2:IF
        {SPACE}Q<1 THEN Q=8
FA 3710 POKE L,PEEK(L) OR 16*Q
SR 3720 A$=WF$(Q):GOSUB2110
EP 3730 A=PEEK(J):IF (A AND 16
        ) <> 0 THEN RETURN
JA 3740 GOTO3680
SJ 3750 L=S+VN*7+4
PQ 3760 IF A=BU THEN POKE L,PE
        EK(L) OR 4:A$=" ON ":G
        OSUB2110:RETURN
XM 3770 IF A=BD THEN POKE L,PE
        EK(L) AND 251:A$=" OFF
        ":GOSUB2110:RETURN
KX 3780 RETURN
MX 3790 L=S+VN*7+4
HS 3800 IF A=BU THEN POKE L,PE
        EK(L) OR 2:A$=" ON ":G
        OSUB2110:RETURN
BB 3810 IF A=BD THEN POKE L,PE
        EK(L) AND 253:A$=" OFF
        ":GOSUB2110:RETURN
BS 3820 RETURN
JX 3830 L=S+VN*7+5:Q=INT(PEEK(
        L)/16)
PH 3840 IF A=BU THEN Q=Q+1:IF
        {SPACE}Q=16 THEN Q=0
QB 3850 IF A=BD THEN Q=Q-1:IF
        {SPACE}Q<0 THEN Q=15
SD 3860 POKE L,PEEK(L) AND 15
SF 3870 POKE L,PEEK(L) OR 16*Q
AR 3880 A$=STR$(Q)+SP$:GOSUB21
        10
PX 3890 A=PEEK(J):IF (A AND 16
        ) <>0 THEN RETURN
JJ 3900 GOTO3840
QH 3910 L=S+VN*7+5:Q=PEEK(L) A
        ND 15
EJ 3920 IF A=BU THEN Q=Q+1:IF
        {SPACE}Q=16 THEN Q=0
KM 3930 IF A=BD THEN Q=Q-1:IF
        {SPACE}Q<0 THEN Q=15
QF 3940 POKE L,PEEK(L) AND 240
CQ 3950 POKE L,PEEK(L) OR Q
QK 3960 A$=STR$(Q)+SP$:GOSUB21
        10
HP 3970 A=PEEK(J):IF (A AND 16
        ) <>0 THEN RETURN
HC 3980 GOTO3920
XP 3990 L=S+VN*7+6:Q=INT(PEEK(
        L)/16)
DG 4000 GOSUB3840
EP 4010 RETURN
MA 4020 L=S+VN*7+6:Q=PEEK(L) A
        ND 15
FE 4030 GOSUB3920
RQ 4040 RETURN
KJ 4050 L=AB-4+VN*VL:Q=PEEK(L+
        2):LF=50991+VN
BS 4060 IF A=BU THEN Q=Q+1:IF
        {SPACE}Q=256 THEN Q=0
BB 4070 IF A=BD THEN Q=Q-1:IF
        {SPACE}Q<0 THEN Q=255
JG 4080 POKE L,1:POKE L+2,Q:PO
        KE LF,Q:POKE LF+6,1
JA 4090 A$=STR$(Q)+SP$:IF Q=0
        {SPACE}THEN A$=" OFF":
        POKE L,0:POKE LF+6,0
EB 4100 GOSUB2110
CC 4110 A=PEEK(J):IF (A AND 16
        )<>0 THEN RETURN
KG 4120 GOTO4060
PR 4130 L=AB-3+VN*VL:Q=PEEK(L+
        2):LF=50994+VN
XJ 4140 GOSUB4060
FG 4150 RETURN
XA 4160 L=S+21:Q=PEEK(L)+8*PEE
        K(L+1)
RS 4170 IF A=BU THEN IF Q<2028
        THEN Q=Q+20
CK 4180 IF A=BD THEN IF Q>20 T
        HEN Q=Q-20
BX 4190 IF K$="{F7}" THEN IF Q
        <2047 THEN Q=Q+1
CG 4200 HI=INT(Q/8):LO=Q-8*HI
XB 4210 POKE L,LO:POKE L+1,HI
GM 4220 A$=STR$(Q)+SP$:GOSUB21
        10
DM 4230 A=PEEK(J):IF (A AND 16
        ) <> 0 THEN RETURN
CQ 4240 GOTO4170
GP 4250 L=S+23:Q=INT(PEEK(L)/1
        6)
MR 4260 IF A=BU THEN Q=Q+1:IF
        {SPACE}Q=16 THEN Q=0
KX 4270 IF A=BD THEN Q=Q-1:IF
        {SPACE}Q<0 THEN Q=15
RF 4280 POKE L,PEEK(L) AND 15
QX 4290 POKE L,PEEK(L) OR 16*Q
BF 4300 A$=STR$(Q)+SP$:GOSUB21
        10
XH 4310 A=PEEK(J):IF (A AND 16
        ) <> 0 THEN RETURN
JA 4320 GOTO4260
AK 4330 L=S+23:Q=PEEK(L) AND 1
        5
QP 4340 FOR I=0 TO 3
KD 4350 Q1=Q OR 2↑I:K1$=CHR$(1
        33+I):IF K$=K1$ THEN I
        F Q<>Q1 THEN Q=Q1:GOTO
        4370
BX 4360 IF K$=K1$ THEN Q=Q AND
        (255-2↑I)
DR 4370 NEXT I
EK 4380 POKE L,PEEK(L) AND 240
HH 4390 POKE L,PEEK(L) OR Q
QH 4400 A$=S1$:GOSUB2110
ED 4410 RF=1:GOSUB3210:RF=0
BH 4420 RETURN
PX 4430 L=S+24:Q=INT(PEEK(L)/1
        6)
FQ 4440 FOR I=0 TO 2
QF 4450 Q1=Q OR 2↑I:K1$=CHR$(1
        33+I):IF K$=K1$ THEN I
        F Q<>Q1 THEN Q=Q1:GOTO
        4470
HF 4460 IF K$=K1$ THEN Q=Q AND
        (255-2↑I)
MC 4470 NEXT I
BK 4480 POKE L,PEEK(L) AND 15
DC 4490 POKE L,PEEK(L) OR 16*Q
GS 4500 A$=S1$:GOSUB2110
JG 4510 RF=1:GOSUB3280:RF=0
HK 4520 RETURN
XE 4530 L=S+24:Q=PEEK(S+24) AN
        D 15
QE 4540 GOSUB3920
QX 4550 RETURN
PS 4560 POKEBO,6:RF=1
FC 4570 GOSUB1240:GETK$:IFK$="
        {HOME}"THENGOSUB5130
AQ 4580 K2=VAL(K$):IFK2=VCTHEN
        ON K2 GOSUB1070,1090,
        1110
GQ 4590 A=PEEK(J):IF(AAND16)<>
        0THEN4570
XK 4600 M1=AD:R1=SA:POKEBO,5
GS 4610 WAITJ,16
JA 4620 GOSUB1240:GETK$:IFK$="
        {HOME}"THENGOSUB5130
EC 4630 K2=VAL(K$):IFK2=VCTHEN
        ON K2 GOSUB1070,1090,
        1110
PF 4640 A=PEEK(J):IF(AAND16)<>
        0THEN4620
XH 4650 M2=AD:R2=SA:IFM2>M1THE
        N4680
AS 4660 T=M1:M1=M2:M2=T
GR 4670 T=R1:R1=R2:R2=T
```

```
GS 4680 M2=M2+3:R2=R2+2:IFM2=B
        E+NC*3+3THENM2=M2-3:R2
        =R2-2
AA 4690 LM=M2-M1:LR=R2-R1
CS 4700 WAITJ,16:POKEBO,0:RF=0
        :RETURN
FP 4710 POKEBO,6:MV=BE+NC*3:PV
        =AD+LM:NA=(PV-MV)/3:IF
        NC+NA>MAORM1=M2THEN479
        0
JP 4720 F=M1:T=AD:L=LM:GOSUB20
        20
CJ 4730 F=R1:T=SA:L=LR:GOSUB20
        20
HM 4740 IFPV>MVTHENNC=NC+NA
RQ 4750 IFLP=7THENLP=6:PP=PP-2
        4:POKEV,PP
RA 4760 GOSUB1900
PP 4770 NT(VC)=NC
HG 4780 RF=1:GOSUB2440:RF=0
RB 4790 POKEBO,0:GOTO920
JC 4800 SYSBB:CLOSE15:OPEN15,8
        ,15,"I0":FORI=1TO500:N
        EXT
KM 4810 GOSUB5210:IFETHEN5100
CH 4820 TP=49151:BM=TP-(NT(1)+
        NT(2)+NT(3))*3-26
BM 4830 H1=INT(BM/256):L1=BM-2
        56*H1
JD 4840 OPEN2,8,8,F$+".OBJ,P,W
        ":GOSUB5090:IFETHEN600
HA 4850 PRINT#2,CHR$(L1);CHR$(
        H1);
GF 4860 FORI=A1TOA1+NT(1)*3+3
PQ 4870 PRINT#2,CHR$(PEEK(I));
JC 4880 IFSTTHEN5090
KB 4890 BM=BM+1:B=B+1:POKEBO,B
        :IFB=15THENB=0
HA 4900 NEXT:PRINT#2,CHR$(254)
        ;:BM=BM+1
PC 4910 H2=INT(BM/256):L2=BM-2
        56*H2
GD 4920 FORI=A2TOA2+NT(2)*3+3
FJ 4930 PRINT#2,CHR$(PEEK(I));
MH 4940 IFSTTHEN5090
MQ 4950 BM=BM+1:B=B+1:POKEBO,B
        :IFB=15THENB=0
KE 4960 NEXT:PRINT#2,CHR$(254)
        ;:BM=BM+1
CP 4970 H3=INT(BM/256):L3=BM-2
        56*H3
CP 4980 FOR I=A3 TO A3+NT(3)*3
        +3
ME 4990 PRINT#2,CHR$(PEEK(I));
PF 5000 IFSTTHEN5090
BC 5010 B=B+1:POKEBO,B:IFB=15T
        HENB=0
HF 5020 NEXT:PRINT#2,CHR$(254)
        ;
BP 5030 FORI=1TO6:PRINT#2,CHR$
        (1);:NEXT
SH 5040 PRINT#2,CHR$(L1)CHR$(H
        1)CHR$(L2)CHR$(H2)CHR$
        (L3)CHR$(H3);
GQ 5050 CLOSE2
EM 5060 SYS50873,F$+".SND",8,5
        0320,50344
GC 5070 X=0:Y=20:A$=S1$+SP$+SP
        $:GOSUB2110:Y=21:GOSUB
        2110
MD 5080 CLOSE15:POKEBO,0:SYSFS
        :GOTO600
EK 5090 INPUT#15,E,E$:IFRFTHEN
        RETURN
HR 5100 IFETHENCLOSE2:X=0:Y=20
        :A$="ERROR - "+E$+M$:G
        OSUB2110
KE 5110 IFETHENPOKE198,0:WAIT1
        98,1:GOTO5070
DC 5120 RETURN
RQ 5130 AD=BE:SA=BS:LP=0:PP=32
        :POKEV,PP:GOSUB1900:GO
        TO1200
MJ 5140 X=0:Y=20:A$="CLEAR THI
        S VOICE: ARE YOU SURE?
        ":GOSUB2110
AF 5150 GETK$:IFK$=""THEN5150
EH 5160 IFK$<>"Y"THEN5180
GM 5170 AD=BE:SA=BS:LP=0:PP=32
        :POKEV,PP:NT(VC)=0:NC=
        0:GOSUB1900
BK 5180 X=0:Y=20:A$=S1$+SP$+SP
        $:GOSUB2110:POKEAD+4,E
        S
AP 5190 S=50320:A=S+(VC-1)*7+4
        :POKEA,PEEK(A)AND254
PB 5200 GOTO920
FM 5210 CLOSE15:OPEN15,8,15
MF 5220 IFK$="E"THENOPEN2,8,2,
        F$+".EDT":INPUT#15,E,E
        $
MX 5230 IFE=0THENE=1:E$="FILE
        {SPACE}EXISTS"
FR 5240 IFE=62THENE=0
KQ 5250 IFK$=""THENOPEN2,8,2,F
        $+".EDT":GOSUB5090:GOT
        O5310
XJ 5260 IFK$<>"O"THEN5310
HC 5270 OPEN2,8,2,F$+".OBJ":IN
        PUT#15,E,E$:IFE=0THENE
        =1:E$="FILE EXISTS":GO
        TO5310
JB 5280 IFE=62THENE=0
XJ 5290 OPEN3,8,2,F$+".SND":IN
        PUT#15,E,E$:CLOSE3:IFE
        =0THENE=1:E$="FILE EXI
        STS"
MB 5300 IFE=62THENE=0
RR 5310 CLOSE2:RETURN
```

SynthPlayer ML

```
C000:78 A9 00 A2 00 9D 00 D4 9D
C008:E8 E0 19 90 F8 A9 35 85 C0
C010:01 AD FA BF 85 FB AD FB 4C
C018:BF 85 FC AD FC BF 85 FD 45
C020:AD FD BF 85 FE AD FE BF B4
C028:85 F7 AD FF BF 85 F8 A0 C6
C030:00 B1 FB 8D 35 C7 C8 B1 82
C038:FB 8D 38 C7 C8 B1 FB 8D 31
C040:2F C7 C8 B1 FB 8D 32 C7 C1
C048:A0 00 B1 FD 8D 36 C7 C8 CD
C050:B1 FD 8D 39 C7 C8 B1 FD 32
C058:8D 30 C7 C8 B1 FD 8D 33 06
C060:C7 A0 00 B1 F7 8D 37 C7 35
C068:C8 B1 F7 8D 3A C7 C8 B1 C6
C070:F7 8D 31 C7 C8 B1 F7 8D 7E
C078:34 C7 18 A5 FB 69 04 85 76
C080:FB 8D F4 BF A5 FC 69 00 F1
C088:85 FC 8D F5 BF 18 A5 FD C4
C090:69 04 85 FD 8D F6 BF A5 C5
C098:FE 69 00 85 FE 8D F7 BF 2A
C0A0:18 A5 F7 69 04 85 F7 8D E0
C0A8:F8 BF A5 F8 69 00 85 F8 2A
C0B0:8D F9 BF A9 01 8D 20 C7 50
C0B8:8D 21 C7 8D 22 C7 8D 23 89
C0C0:C7 8D 24 C7 8D 25 C7 8D A8
C0C8:2C C7 8D 2D C7 8D 2E C7 6F
C0D0:8D 29 C7 8D 2A C7 8D 2B EB
C0D8:C7 8D 3B C7 8D 3C C7 8D FF
C0E0:3D C7 A9 03 8D 26 C7 8D 7A
C0E8:27 C7 8D 28 C7 A9 FD 8D 92
C0F0:14 03 A9 C0 8D 15 03 A9 EE
C0F8:37 85 01 58 60 A9 35 85 B6
C100:01 CE 20 C7 AD 20 C7 D0 86
C108:79 AD 29 C7 49 01 8D 29 E7
C110:C7 AD 29 C7 F0 15 AD 94 50
C118:C4 29 FE 8D 94 C4 A9 01 0D
C120:8D 20 C7 A0 00 B1 FB C9 FD
C128:FE D0 57 A0 00 B1 FB C9 DC
C130:FE D0 1F AD F4 BF 85 FB D3
C138:AD F5 BF 85 FC A9 78 8D 6D
C140:20 C7 A9 01 8D 29 C7 AD 59
C148:3B C7 D0 03 4C 0A C5 4C 08
C150:82 C1 8D 20 C7 C8 B1 FB F9
C158:F0 1B 8D 90 C4 C8 B1 FB 7E
C160:8D 91 C4 AD 94 C4 09 01 4D
C168:8D 94 C4 A9 03 8D 26 C7 6D
C170:A9 01 8D 23 C7 18 A5 FB D2
C178:69 03 85 FB A5 FC 69 00 D5
C180:85 FC AD 35 C7 F0 44 AD 47
C188:2C C7 F0 21 18 AD 92 C4 A5
C190:6D 2F C7 8D 92 C4 AD 93 FE
C198:C4 69 00 8D 93 C4 C9 0F 04
C1A0:90 29 AD 2C C7 49 01 8D 22
C1A8:2C C7 4C CB C1 38 AD 92 57
C1B0:C4 ED 2F C7 8D 92 C4 AD 62
C1B8:93 C4 E9 00 8D 93 C4 C9 82
C1C0:01 B0 08 AD 2C C7 49 01 E0
C1C8:8D 2C C7 AD 38 C7 F0 5A 0F
C1D0:AD 23 C7 F0 2C 18 AD 90 A9
C1D8:C4 6D 32 C7 8D 90 C4 AD C2
C1E0:91 C4 69 00 8D 91 C4 EE B6
C1E8:26 C7 AD 26 C7 C9 06 90 8B
C1F0:39 AD 23 C7 49 01 8D 23 E9
C1F8:C7 A9 00 8D 26 C7 4C 2A B6
C200:C2 38 AD 90 C4 ED 32 C7 BD
C208:8D 90 C4 AD 91 C4 E9 00 5F
C210:8D 91 C4 EE 26 C7 AD 26 1A
C218:C7 C9 06 90 0D AD 23 C7 EA
C220:49 01 8D 23 C7 A9 00 8D E0
C228:26 C7 CE 21 C7 AD 21 C7 9D
C230:D0 79 AD 2A C7 49 01 8D C7
C238:2A C7 AD 2A C7 F0 15 AD F6
C240:9B C4 29 FE 8D 9B C4 A9 E7
C248:01 8D 21 C7 A0 00 B1 FD B8
C250:C9 FE D0 57 A0 00 B1 FD 70
C258:C9 FE D0 1F AD F6 BF 85 DC
C260:FD AD F7 BF 85 FE A9 78 3F
C268:8D 21 C7 A9 01 8D 2A C7 EA
C270:AD 3C C7 D0 03 4C 0A C5 05
C278:4C AB C2 8D 21 C7 C8 B1 AB
C280:FD F0 1B 8D 97 C4 C8 B1 90
C288:FD 8D 98 C4 AD 9B C4 09 3E
C290:01 8D 9B C4 A9 03 8D 27 55
C298:C7 A9 01 8D 24 C7 18 A5 7B
C2A0:FD 69 03 85 FD A5 FE 69 26
C2A8:00 85 FE AD 39 C7 F0 5A 6F
C2B0:AD 24 C7 F0 2C 18 AD 97 D2
C2B8:C4 6D 33 C7 8D 97 C4 AD E0
C2C0:98 C4 69 00 8D 98 C4 EE 38
C2C8:27 C7 AD 27 C7 C9 06 90 FD
C2D0:39 AD 24 C7 49 01 8D 24 EC
C2D8:C7 A9 00 8D 27 C7 4C 0A 80
C2E0:C3 38 AD 97 C4 ED 33 C7 91
C2E8:8D 97 C4 AD 98 C4 E9 00 3A
C2F0:8D 98 C4 EE 27 C7 AD 27 C5
C2F8:C7 C9 06 90 0D AD 24 C7 CD
C300:49 01 8D 24 C7 A9 00 8D D2
C308:27 C7 AD 36 C7 F0 44 AD 66
C310:2D C7 F0 21 18 AD 99 C4 BF
C318:6D 30 C7 8D 99 C4 AD 9A 0A
C320:C4 69 00 8D 9A C4 C9 0F C7
C328:90 29 AD 2D C7 49 01 8D BD
C330:2D C7 4C 53 C3 38 AD 99 F2
C338:C4 ED 30 C7 8D 99 C4 AD 2A
C340:9A C4 E9 00 8D 9A C4 C9 AD
C348:01 B0 08 AD 2D C7 49 01 74
C350:8D 2D C7 CE 22 C7 AD 22 7D
C358:C7 D0 79 AD 2B C7 49 01 0E
C360:8D 2B C7 AD 2B C7 F0 15 BC
C368:AD A2 C4 29 FE 8D A2 C4 D2
C370:A9 01 8D 22 C7 A0 00 B1 53
C378:F7 C9 FE D0 57 A0 00 B1 4A
C380:F7 C9 FE D0 1F AD F8 BF C4
C388:85 F7 AD F9 BF 85 F8 A9 D5
C390:78 8D 22 C7 A9 01 8D 2B 10
C398:C7 AD 3D C7 D0 03 4C 0A C8
C3A0:C5 4C D4 C3 8D 22 C7 C8 42
C3A8:B1 F7 F0 1B 8D 9E C4 C8 10
C3B0:B1 F7 8D 9F C4 AD A2 C4 A1
C3B8:09 01 8D A2 C4 A9 03 8D 41
C3C0:28 C7 A9 01 8D 25 C7 18 3C
C3C8:A5 F7 69 03 85 F7 A5 F8 CE
C3D0:69 00 85 F8 AD 37 C7 F0 18
C3D8:44 AD 2E C7 F0 21 18 AD 1A
C3E0:A0 C4 6D 31 C7 8D A0 C4 25
C3E8:AD A1 C4 69 00 8D A1 C4 1D
C3F0:C9 0F 90 29 AD 2E C7 49 C4
C3F8:01 8D 2E C7 4C 1D C4 38 3F
C400:AD A0 C4 ED 31 C7 8D A0 64
C408:C4 AD A1 C4 E9 00 8D A1 EB
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C410:C4 C9 01 B0 08 AD 2E C7 B4
C418:49 01 8D 2E C7 AD 3A C7 4C
C420:F0 5A AD 25 C7 F0 2C 18 33
C428:AD 9E C4 6D 34 C7 8D 9E 1A
C430:C4 AD 9F C4 69 00 8D 9F CD
C438:C4 EE 28 C7 AD 28 C7 C9 C8
C440:06 90 39 AD 25 C7 49 01 CE
C448:8D 25 C7 A9 00 8D 28 C7 C3
C450:4C 7C C4 38 AD 9E C4 ED 9A
C458:34 C7 8D 9E C4 AD 9F C4 6A
C460:E9 00 8D 9F C4 EE 28 C7 84
C468:AD 28 C7 C9 06 90 0D AD A2
C470:25 C7 49 01 8D 25 C7 A9 F1
C478:00 8D 28 C7 A2 00 BD 90 08
C480:C4 9D 00 D4 E8 E0 19 90 AE
C488:F5 A9 37 85 01 4C 31 EA 3D
C490:4E 1C 40 0D 41 35 CC 18 B1
C498:26 FF 07 40 35 CC CF 22 B8
C4A0:20 0E 40 35 CC 03 7D F0 77
C4A8:2F A2 00 BD F8 C5 9D C0 29
C4B0:02 9D 80 03 E8 E0 40 90 BE
C4B8:F2 A2 00 BD 38 C6 9D 40 98
C4C0:03 9D C0 03 E8 E0 40 90 57
C4C8:F2 AD BE 03 09 0F 8D BE 9D
C4D0:03 8D FE 03 AD BB 03 09 BA
C4D8:0F 8D BB 03 8D FB 03 AD 05
C4E0:B8 03 09 0F 8D B8 03 8D 7C
C4E8:F8 03 A2 00 BD 78 C6 9D FE
C4F0:00 08 E8 E0 40 90 F5 60 38
C4F8:78 A9 31 8D 14 03 A9 EA 13
C500:8D 15 03 A9 00 8D 18 D4 CD
C508:58 60 78 A9 31 8D 14 03 6C
C510:A9 EA 8D 15 03 A9 00 8D 7A
C518:18 D4 A9 37 85 01 58 4C BA
C520:31 EA 78 18 AD 58 C5 8D 77
C528:F2 CF AD 59 C5 8D F3 CF 88
C530:AD 58 C5 6D F0 CF 8D 58 72
C538:C5 AD 59 C5 6D F1 CF 8D F9
C540:59 C5 18 AD 5B C5 6D F0 85
C548:CF 8D 5B C5 AD 5C C5 6D BE
C550:F1 CF 8D 5C C5 A2 00 BD B6
C558:9E 82 9D A0 82 AD 58 C5 D2
C560:CD F2 CF D0 0A AD 59 C5 16
C568:CD F3 CF D0 02 58 60 CE DF
C570:58 C5 AD 58 C5 C9 FF D0 FA
C578:03 CE 59 C5 CE 5B C5 AD DD
C580:5B C5 C9 FF D0 CF CE 5C 24
C588:C5 4C 55 C5 18 AD A3 C5 95
C590:6D F0 CF 8D F4 CF AD A4 C8
C598:C5 6D F1 CF 8D F5 CF 78 F9
C5A0:A2 00 BD AA 82 9D 5D 6D 92
C5A8:EE A3 C5 AD A3 C5 D0 03 01
C5B0:EE A4 C5 EE A6 C5 AD A6 D2
C5B8:C5 D0 03 EE A7 C5 AD A3 FD
C5C0:C5 CD F4 CF D0 DA AD A4 30
C5C8:C5 CD F5 CF D0 D2 58 60 49
C5D0:A9 64 A2 00 9D F0 04 9D F4
C5D8:18 05 9D 40 05 9D 68 05 DD
C5E0:9D 90 05 9D E0 05 9D 08 38
C5E8:06 9D 30 06 9D 58 06 9D 3D
C5F0:80 06 E8 E0 19 D0 DD 60 91
C5F8:00 00 00 00 00 00 00 00 84
C600:C0 00 00 E0 00 00 F0 00 DD
C608:00 F8 00 00 D8 00 00 D8 73
C610:00 00 D8 00 00 CC 00 00 EB
C618:CC 00 00 CC 00 00 CC 01 73
C620:FC C0 0F FF C0 1F FF C0 81
C628:3F FF C0 1F FF 80 0F FF 7F
C630:00 01 FC 00 00 00 00 00 9D
C638:00 00 00 00 00 00 18 60 56
C640:C0 18 60 E0 7F F8 F0 18 28
C648:60 F8 18 60 D8 18 60 D8 0E
C650:7F F8 D8 18 60 CC 18 60 3F
C658:CC 00 00 CC 00 00 CC 01 B3
C660:FC C0 0F FF C0 1F FF C0 C1
C668:3F FF C0 1F FF 80 0F FF BF
C670:00 01 FC 00 00 00 00 00 DD
C678:00 00 00 00 00 00 00 00 06
C680:00 00 00 00 00 00 00 00 0E
C688:00 00 00 00 00 3F FF F8 0C
C690:3F FF FC 3F FF FA 3F FF BB
C698:FD 3F FF FA 3F FF FD 3F D9
C6A0:FF FA 3F FF FD 3F FF FA BC
C6A8:3F FF FD 3F FF FA 3F FF F3
C6B0:FD 0A AA AA 05 55 55 00 E7
C6B8:00 20 FD AE 20 9E AD 20 EF
C6C0:82 B7 A6 22 A4 23 20 BD 24
C6C8:FF 20 9B B7 A9 02 A8 20 14
C6D0:BA FF 20 E9 C6 A5 14 85 D8
C6D8:FB A5 15 85 FC 20 E9 C6 CB
C6E0:A6 14 A4 15 A9 FB 4C D8 5B
C6E8:FF 20 FD AE 20 9E AD 4C 4C
C6F0:F7 B7 00 A2 00 A9 18 18 81
C6F8:7D 02 D0 9D 02 D0 E8 E8 C7
C700:E0 0E 90 F1 60 A2 00 BD FF
C708:02 D0 38 E9 18 9D 02 D0 7E
C710:E8 E8 E0 0E 90 F1 60 00 58
C718:00 FF 00 FF 00 FF 00 FF A7
C720:03 2E 2E 00 00 00 02 00 86
C728:00 00 01 01 00 01 00 20 0C
C730:00 20 1E 1E 1E 01 01 01 65
C738:01 01 01 01 01 01 00 BF 84
C740:00 FF 00 FF 00 FF 00 FF CF
C748:00 FF 00 FF 00 FF 00 FF D7
C750:A2 06 BD 72 C7 9D F9 07 41
C758:CA 10 F7 A2 0D BD 79 C7 94
C760:9D 02 D0 CA 10 F7 A2 06 B1
C768:BD 87 C7 9D 28 D0 CA 10 B5
C770:F7 60 0B 0B 0B 0B 0B 0B CB
C778:0B 20 00 38 00 50 00 68 C2
C780:00 80 00 98 00 B0 00 02 7E
C788:02 02 02 02 02 02 78 A9 AC
C790:A3 8D 14 03 A9 C7 8D 15 A4
C798:03 A9 00 8D D4 C7 8D D5 A3
C7A0:C7 58 60 EE D4 C7 AD D4 1B
C7A8:C7 C9 05 90 1D A9 00 8D 55
C7B0:D4 C7 AE D5 C7 BD CD C7 68
C7B8:8D 27 D0 EE D5 C7 AD D5 E0
C7C0:C7 C9 07 90 05 A9 00 8D EC
C7C8:D5 C7 4C 31 EA 06 0E 03 60
C7D0:0D 03 0E 06 03 00 00 00 E1
C7D8:00 00 00 00 00 00 00 00 68
```


"She had big brown eyes, the cutest laugh– and leukemia."

"Andrea was in preschool with my son.

"One day they rushed her to the hospital with leukemia. She needed blood urgently, so I went and gave... She's in remission now, but every couple of months I go and give blood.

"Because I know someone else's Andrea may need it."

When was the last time *you* gave blood?

Blood. Give a little, so someone can live.

National Blood Resource Education Program.

National Heart, Lung, and Blood Institute, National Institutes of Health, Public Health Service, U.S. Department of Health and Human Services

COLOR RIBBONS & PAPER

RIBBONS: Red, Blue, Grn., Brwn., Purple, Yel.

Ribbons — Price Each	Black	Color	Heat Transfer
Brother M1109	4.95	5.95	7.00
C. Itoh Prowriter Jr.	7.00	9.00	–
Citizen 120D/180D	5.00	6.00	7.95
Commodore MPS 801	4.50	5.25	5.75
- MPS 802/1526	6.25	7.25	–
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FERNANDO BUELNA SANCHEZ

BASSEM

A MACHINE LANGUAGE ASSEMBLER FOR THE 64 PART 1

EDITOR'S CHOICE

Push your computer to the limit with this outstanding, full-featured assembler for the 64. Now you'll be able to write machine language programs more quickly and easily than ever before. Because of the size and scope of this article, we've divided it into two parts. This month, we introduce you to the assembler and show you the basics of its use. Next month, we'll cover all its commands in detail, including many examples.

Bassem is a two-pass assembler that contains many features and commands normally found only on commercial assemblers like the Commodore Macro Assembler, Buddy 64, or Merlin64. This versatile assembler can assemble to memory, to disk, or to both. And, if you want to check the syntax of your source program, *Bassem* can assemble without creating any code at all. In addition, *Bassem* has commands that make programming quite convenient. For example, FLP gives you easy access to floating-point values, and OPZ gives you precise control over zero-page addressing.

Although it has a wealth of commands, *Bassem*'s most powerful feature is its ability to work as an extension of the 64's operating system. To the more than 150 commands supported by BASIC 2.0, *Bassem* adds assembly control commands, disk commands, editing commands, and 6502 machine language instructions. And, because it runs within the BASIC environment, you can use the built-in screen editor to enter and edit your programs, and you can use BASIC's commands to control how your programs assemble. For example, you can use IF-THEN statements for conditional assembly or FOR-NEXT loops to generate tables.

Getting Started

Bassem is written entirely in machine language (ML), so you'll need to use *MLX*, the machine language entry program found elsewhere in this issue, to type it in. When *MLX* prompts you, respond with the values given below.

Starting address: 87DE
Ending address: A005

When you've finished entering the data, be sure to save a copy of the program to disk before exiting *MLX*.

To use *Bassem*, load the program with a statement of the form LOAD *"filename"*,8,1, where *filename* is the name you used when you saved the file from *MLX*. Next, type NEW and then enter SYS 34782. *Bassem* installs itself and then displays a startup message.

Also listed at the end of this article are four example source programs written using *Bassem*. Because *Bassem* runs in the BASIC environment, you can enter these programs as you would any other BASIC program.

To do so, first run *Bassem;* then load and run *The Automatic Proofreader,* also found elsewhere in this issue. A typing error in *Bassem* or one of the example programs could cause your computer to lock up, so be sure to save a copy of each program to disk before you attempt to run it.

The Examples

To execute the example programs, you must assemble them with *Bassem*. The first two examples, Directory and Screen Saver, assemble directly to memory and can be executed immediately after the assembly finishes. The third and fourth example programs are two halves of the same program; they assemble to disk as a single ML program. To execute the resulting program, you should load the file from disk and then SYS to it.

To execute the machine language code generated from Directory, type SYS 49152. The directory of the disk in drive 8 will be displayed. You can pause the display by pressing one of the SHIFT keys; releasing the key continues the display.

The machine language routine generated from Screen Saver has two entry points. The first, accessed by typing SYS 49155, saves the current screen into a buffer. The second, accessed by typing SYS 49152, restores the screen from the buffer. You'll notice that the source code for this example uses FOR-NEXT loops to generate the code for the screen save and restore routines. This method of moving values from one area to another

is by far the simplest and fastest, but it requires too much memory and is too inflexible to be of any practical use. It's presented here to illustrate how well *Bassem* and BASIC work together.

The third and fourth example programs represent two halves of the source code for one program. We could have combined these two into a single, larger file, but we wrote them separately to show you how to handle multiple source files with *Bassem*.

To assemble these files, load the first part, Split Source Part 1, and run it. *Bassem* assembles this file and then automatically loads and assembles Split Source Part 2. *Bassem* writes the object code for these two files to disk as a machine language file with the name SPLIT. To execute the resulting ML file, type LOAD"SPLIT",8,1 and press RETURN. Once the program has loaded, type NEW to clear BASIC's pointers. Then type SYS 49152 to start the program.

When you first execute it, the program changes the border color to gray. It prints a message onscreen one word at a time when you press one of the SHIFT keys. Each time you press SHIFT, a new word appears on the screen. Once the message is complete, the program creates a clever interrupt effect in the border of the screen and requests that you press the space bar to continue. When you press the space bar, the screen returns to normal and the program ends.

Using the Assembler

The first step in creating a machine language program is entering the source code. With *Bassem*, this is done using the familiar BASIC screen editor. You simply enter each line of code with a line number as you would a BASIC program. For example, the source code for a simple program to change the screen border color to cyan might look like this:

```
10 WRT 1: SET $A000, $B000: BAS $C000
20 PASS 1:' BEGIN ASSEMBLY
30 ←BORDER = $D020
40 ←COLOR = 3:' THE VALUE FOR
   CYAN
50 ←START LDA #←COLOR: STA
   ←BORDER: RTS
60 PASS 2:' END ASSEMBLY
```

In line 10, the WRT command tells *Bassem* to write the machine language to memory, the SET command establishes the label buffer, and the BAS command sets the starting address for the program. (If you don't understand what's going on, don't worry; we'll discuss each of these in more detail later.) The PASS 1 command in line 20 tells the assembler that the following lines should be assembled. *Bassem* continues assembling commands until it encounters a PASS 2 command (line 60). As you may have guessed, the text immediately following the PASS 1 command is a comment; *Bassem* treats the ' character as a REM statement.

Lines 30 and 40 assign values to the labels BORDER and COLOR. *Bassem* labels are always preceded by a ← (left-arrow character) and can be up to 40 characters long. They can contain letters of the alphabet, numerical digits, and the decimal point. They may also contain BASIC keywords and reserved variables. Some examples of valid labels are THIS.IS.A.LABEL, PRINTOUT, and 3RD.JMP.

There are two ways to assign a value to a label. As you can see in lines 30 and 40, you can assign a value to a label using the assignment (=) command. When defining labels this way, you can use hexadecimal (base 16), octal (base 8), binary (base 2), or decimal (base 10) constants or expressions. Hexadecimal values must be preceded by a $ character; octal values, by an &; and binary values, by a % character. Decimal values are the default and require no prefix.

When you use an expression to define a label, you must abide by a few rules. First, with one exception, the expression must be a valid BASIC expression. The exception is that you can use hexadecimal, octal, and binary constants in the expression. Second, *Bassem* must be able to evaluate the expression during assembly. For example, the expression can't be based on the contents of the accumulator, because *Bassem* has no way of knowing what will be in the accumulator when the program is run.

The other way to give a label a value is to place it in front of a 6502 mnemonic. Line 50 contains an example of this method. Labels used this way take on the value of the program counter. This value corresponds to the address of the instruction. For example, in line 50, the LDA instruction is at location $C000 (49152), so the label START has a value of 49152. Placing a label on a line by itself immediately before a line containing an opcode produces the same result.

Line 50 demonstrates one more feature of *Bassem*—you're not limited to one instruction per line. You can fill an entire logical line (two screen lines) with instructions and labels. Simply separate the instructions with colons, just as you would in BASIC.

After you've entered the source code for your program, be sure to save it before you continue. Since *Bassem* operates in the BASIC environment, you can save your source files just as you would a BASIC program. The next step is to assemble your program. Assembling with *Bassem* is very easy; you simply load your source code and type RUN. *Bassem* will assemble your program and save it to memory or to disk, depending upon the destination you've indicated.

Mnemonics and Pseudo-Ops

Bassem supports all 6502 addressing modes and instructions as shown in the *Commodore 64 Programmer's Reference Guide*. In addition, it supports several pseudo-ops which instruct the assembler on how to generate code. The following paragraphs summarize the pseudo-ops that you'll need to know to start using *Bassem*, including the ones demonstrated in the example above. In each description, optional parameters are indicated by square brackets, and repeating parameters are represented by ellipses. When only one of several choices is allowed, the parameters are surrounded by parentheses and separated by vertical bars.

BAS ***address*** Sets the program counter (PC) to the specified address. The BAS command is usually used to define the starting address for the program. The *address* parameter must be a value between 0 and 65535. If you don't set the starting address, *Bassem* assumes a default value of $C000 (49152).

BUF ***number of bytes[,byte]*** . . . Reserves space for the specified number of bytes. The first parameter of the BUF command is required and tells *Bassem* how many bytes of memory to reserve within the object code. Legal values range from 1 to 65535. Optionally, BUF may be followed by byte values which determine how the reserved space is filled.

If BUF is followed by only one value, the number of memory locations specified by the value is filled with 0s. Otherwise, it's filled with the pattern established by the given values. For example, if you enter the command BUF 8, 2, 2, 3, *Bassem* will write 2, 2, 3, 2, 2, 3, 2, 2 to the object file. Legal values for the fill-byte parameters are between 0 and 255.

BYT ***(number\|string)[,(number\|string)]*** . . . Places the specified byte(s) or string(s) into the object file. If you specify a number or numerical expression, *Bassem* places that value into the object file. Legal values range from 0 to 255. If you specify a string, *Bassem* places each character of the string into a byte. You can specify multiple byte values or strings with one BYT command by separating each with a comma (see the example programs).

PASS (1\|2) Tells the assembler where to begin and end assembly. The PASS 1 command lets the assembler know where to begin assembling code. You must place the PASS 1 command just

before the first label definition or machine language instruction to be assembled. The PASS 2 command indicates the end of the program and must be placed just after the last label definition or machine language instruction.

SET *starting label address,ending label address* Specifies the location of the label buffer. The SET command is used to define the buffer where *Bassem* stores labels as it assembles. The first argument sets the beginning of the buffer, and the second argument sets the end. If you don't specify a location for the label buffer, *Bassem* places it under BASIC ROM ($A000–$BFFF). When defining the label buffer, be sure to use an area of memory that won't conflict with BASIC, *Bassem*, or your object code (if you are writing it to memory). In general, it's best to use areas above $A000.

WRT (01) Specifies whether or not the object code should be written to memory. If the parameter following WRT is 0, the assembler won't write the code to memory. If the parameter is 1, *Bassem* writes the code to memory. The WRT command is useful when you don't want to place the code in memory but you want to check the syntax of your program or to assemble it to disk.

Next month, we'll present the remaining *Bassem* commands, along with more examples and some tips on programming with *Bassem*.

Bassem

```
87DE:20 30 9C A2 0B BD 03 9D BA
87E6:9D 00 03 CA 10 F7 A9 83 09
87EE:A2 9B 8D 26 03 8E 27 03 ED
87F6:20 3E 9A A9 DC A2 87 85 99
87FE:37 86 38 A9 E7 A2 9C 8D 7D
8006:18 03 8E 19 03 A9 80 8D 94
800E:8A 02 A9 93 20 47 AB A9 72
8016:06 20 EA 9B A2 00 BD 86 60
801E:9F F0 06 20 47 AB E8 D0 89
8026:F5 A9 09 20 EA 9B 20 30 F5
802E:E4 20 D7 9C 4C 74 A4 00 FB
8036:8D 35 88 68 CD 1F 9D D0 E9
803E:02 A9 FD C8 99 FB 01 E8 AE
8046:BD 00 02 C9 2E F0 F4 C9 FB
804E:30 90 23 CD 35 88 B0 1E 28
8056:C9 3A 90 E7 C9 41 B0 E3 04
805E:90 14 A6 7A A0 04 84 0F 66
8066:BD 00 02 F0 6C 10 07 C9 21
806E:FF F0 66 E8 D0 F2 C9 20 1D
8076:F0 5F 85 08 C9 22 F0 7D 3F
807E:24 0F 70 55 48 C9 24 D0 4B
8086:04 A9 47 D0 AB CD 1F 9D 6A
808E:D0 04 A9 5B D0 A2 68 C9 9F
8096:21 D0 04 A9 85 D0 3A C9 35
809E:3F D0 04 A9 99 D0 32 C9 DC
80A6:27 D0 09 C8 99 FB 01 E8 D4
80AE:A9 00 F0 3E C9 30 90 04 CA
80B6:C9 3C 90 1D 84 71 A0 00 CA
80BE:84 0B 88 86 7A CA C8 E8 C7
80C6:BD 00 02 38 F9 9E A0 F0 F6
80CE:F5 C9 80 D0 2F 05 0B A4 B2
80D6:71 E8 C8 99 FB 01 C9 00 05
80DE:F0 38 38 E9 3A F0 04 C9 83
80E6:49 D0 02 85 0F 38 E9 55 EB
80EE:D0 82 85 08 BD 00 02 F0 1D
80F6:E0 C5 08 F0 DC C8 99 FB 33
80FE:01 E8 D0 F0 A6 7A E6 0B EB
8106:C8 B9 9D A0 10 FA B9 9E 28
810E:A0 D0 B5 F0 0F BD 00 02 DC
8116:10 BD 99 FD 01 C6 7B A9 77
811E:FF 85 7A 60 A0 00 84 0B 01
8126:F0 02 C8 E8 BD 00 02 38 04
812E:F9 74 9D F0 F5 C9 80 D0 C6
8136:21 A5 0B C9 11 90 16 18 50
813E:69 6F 48 A9 FE E6 71 A4 A0
8146:71 99 FB 01 68 E8 C8 99 1A
814E:FB 01 4C 66 88 69 CC 4C 5F
8156:D5 88 A6 7A E6 0B C8 B9 A1
815E:73 9D 10 FA B9 74 9D D0 EF
8166:C3 F0 AA 08 2C FB 9F 10 0E
816E:0B 48 CC FE 9F D0 04 A9 94
8176:01 85 C7 68 2C F7 9F 30 9B
817E:4F 28 10 18 24 0F 30 14 98
8186:C9 FF F0 10 C9 FD D0 05 8A
818E:AD 1F 9D D0 07 C9 CC B0 AA
8196:06 4C 24 A7 4C F3 A6 C9 08
819E:DD 90 0C C9 FE D0 F2 C8 CC
81A6:B1 5F 38 E9 6E D0 03 38 05
81AE:E9 CB AA 84 49 A0 FF CA DE
81B6:F0 08 C8 B9 74 9D 10 FA 2E
81BE:30 F5 C8 B9 74 9D 30 05 9B
81C6:20 47 AB D0 F5 4C EF A6 A5
81CE:28 30 6A C9 3A D0 1D 24 5F
81D6:0F 30 C1 8D F8 9F 20 47 5C
81DE:AB A9 20 20 47 AB C8 B1 64
81E6:5F 88 C9 27 F0 03 20 D7 23
81EE:AA 4C 00 A7 AE F8 9F 8D 0B
81F6:F8 9F C9 FD D0 16 24 0F BD
81FE:30 9A AD 1F 9D E0 3A F0 4E
8206:04 C0 04 D0 8F 48 20 E8 A1
820E:9B 68 D0 88 C9 27 D0 12 4C
8216:24 0F 30 80 C0 04 D0 03 C9
821E:4C 9A 89 48 20 DF 9B 68 D5
8226:D0 E8 24 0F 30 EC E0 3A 84
822E:F0 04 C0 04 D0 DC 48 20 BF
8236:E5 9B 68 D0 D5 24 0F 30 CC
823E:D9 C9 FD F0 AF C9 FF F0 17
8246:ED C9 CC 90 08 48 20 E2 EB
824E:9B 68 4C 9D 89 C9 A3 90 F9
8256:13 C9 AF D0 07 48 20 E2 E6
825E:9B 68 D0 0D C9 B0 F0 F5 2F
8266:C9 B2 D0 05 48 20 E5 9B A1
826E:68 4C 97 89 A9 00 85 0D BB
8276:20 73 00 C9 23 D0 15 A5 41
827E:14 48 A5 15 48 20 37 99 80
8286:20 A2 B3 68 85 15 68 85 28
828E:14 4C D3 8A C9 24 F0 12 B6
8296:C9 25 F0 3F C9 26 F0 5D 12
829E:C9 FD F0 7E 20 79 00 4C 51
82A6:8D AE 20 49 8B 20 73 00 8A
82AE:90 0B C9 41 90 1F C9 47 F7
82B6:B0 1B 38 E9 07 38 E9 30 AD
82BE:48 A5 61 F0 07 18 69 04 0C
82C6:B0 0E 85 61 68 F0 DE 20 63
82CE:7E BD 4C AB 8A 4C 79 00 4F
82D6:4C 7E B9 20 49 8B 20 73 17
82DE:00 C9 32 B0 F0 C9 30 90 57
82E6:EC E9 30 48 A5 61 F0 04 10
82EE:E6 61 F0 E4 68 F0 E7 20 33
82F6:7E BD 4C DC 8A 20 49 8B 05
82FE:20 73 00 C9 38 B0 CE C9 89
8306:30 90 CA E9 30 48 A5 61 A0
830E:F0 07 18 69 03 B0 C1 85 DC
8316:61 68 F0 E4 20 7E BD 4C 27
831E:FE 8A 20 49 8B 20 1D 99 A0
8326:20 37 97 20 6F 97 90 07 12
832E:A2 1F A9 9F 4C 81 9A A4 CF
8336:14 A5 15 84 63 85 62 A2 44
833E:90 38 20 49 BC 20 2A 99 98
8346:4C D3 8A A9 00 A2 0A 95 98
834E:5D CA 10 FB 60 A9 00 8D BF
8356:00 02 8A 30 06 20 02 9C 93
835E:4C 3A A4 4C 74 A4 AD F6 0C
8366:9F F0 03 20 4B 91 2C ED D2
836E:9F 10 41 AD 00 02 F0 3C 82
8376:C9 20 F0 38 18 A5 14 6D 09
837E:EB 9F AA A5 15 6D EC 9F FA
8386:C9 FA B0 28 86 14 85 15 7E
838E:20 13 A6 90 05 A9 27 20 95
8396:47 AB A6 14 A5 15 20 CD E1
839E:BD A9 20 20 47 AB A9 91 D2
83A6:A2 11 8D 77 02 8E 78 02 B9
83AE:A9 02 85 C6 4C 83 A4 20 12
83B6:73 00 20 BE 8B 4C AE A7 0A
83BE:C9 FE D0 03 4C 46 92 C9 2F
83C6:FD F0 33 C9 CC 90 04 C9 96
83CE:DD 90 1B C9 AF D0 03 4C 0C
83D6:2B 93 C9 B0 D0 03 4C 3E 16
83DE:93 C9 27 D0 03 4C 3B A9 8D
83E6:20 79 00 4C ED A7 38 E9 99
83EE:CC 0A AA BD 71 9E 48 BD 74
83F6:70 9E 48 4C 73 00 24 02 A1
83FE:10 06 20 13 9A 4C 16 8C 93
8406:20 37 97 20 49 9A 20 79 60
840E:00 C9 B2 F0 09 20 A6 97 AC
8416:20 79 00 4C BE 8B 20 73 3A
841E:00 C9 23 D0 08 20 37 99 E3
8426:98 A0 00 F0 12 20 9E AD BE
842E:24 0D 10 12 20 A3 B6 A0 5D
8436:00 C9 00 F0 02 B1 22 85 71
843E:14 84 15 4C A6 97 20 F7 B5
8446:B7 4C A6 97 20 8F 9B 20 33
844E:79 00 D0 04 A9 00 F0 0A B7
8456:20 9E AD 24 0D 10 33 20 4E
845E:0E 9B 20 BD FF 20 72 9B 46
8466:8D EE 9F 20 92 9C AE D8 35
846E:9F A0 0F 20 BA FF 20 C1 3B
8476:E1 AE EE 9F 20 1E E1 20 61
847E:24 E1 20 47 AB C9 0D D0 0A
8486:F6 AD EE 9F 20 C3 FF 4C BA
848E:CC FF 20 F7 B7 AA F0 03 DE
8496:4C 30 9B C0 08 90 F9 C0 98
849E:0C B0 F5 8C D7 9F 60 C9 39
84A6:00 D0 03 4C 08 AF 8D EA 1E
84AE:9F A0 01 B1 7A F0 F4 CD 4A
84B6:EA 9F F0 06 99 D0 02 C8 88
84BE:D0 F1 88 F0 E6 8C D0 02 E9
84C6:C8 C8 20 55 9A 20 D7 AA 7F
84CE:20 8B 9A 20 A5 9A A9 AC C7
84D6:A0 98 20 9E 9A A9 11 A0 92
84DE:8D 20 B8 9A A6 2B A5 2C E0
84E6:86 5F 85 60 A0 01 B1 5F 9D
84EE:F0 2C C8 B1 5F 85 14 C8 C1
84F6:B1 5F 85 15 A2 00 C8 B1 1B
84FE:5F F0 2A DD D1 02 D0 F4 54
8506:E8 EC D0 02 90 F0 A0 02 96
850E:4C D8 A6 8A 10 0B A5 91 8C
8516:C9 7F D0 D0 F0 03 09 80 43
851E:AA 20 98 9A 20 B2 9A 20 74
8526:2C A8 4C 88 E3 A8 B1 5F 18
852E:AA C8 B1 5F 4C E6 8C D0 E4
8536:03 4C 03 8E C9 9C D0 10 A1
853E:AD D1 9F 85 FD AD D2 9F DC
8546:85 FE 20 DA 97 4C 73 00 6A
854E:C9 2C D0 06 A9 00 A8 4C BE
8556:C5 8D 20 9E AD 24 0D 10 CD
855E:63 20 A3 B6 8D DE 9F 20 5A
8566:60 9A 20 AD 98 20 03 98 1B
856E:F0 76 AA BD D0 02 29 7F 31
8576:9D D0 02 AD DE 9F EC DE DD
857E:9F 90 08 8E E0 9F 8D DF F7
8586:9F B0 06 8E DF 9F 8D E0 C0
858E:9F A0 00 B1 22 C9 2A F0 3A
8596:26 C9 3F F0 05 D9 D1 02 63
859E:D0 CB C8 B1 22 C9 2A F0 C6
85A6:16 CC D0 02 D0 05 CC DE 4D
85AE:9F F0 0C CC E0 9F B0 B5 C0
85B6:CC DF 9F B0 B0 90 D4 20 C0
85BE:42 9C 30 A9 20 F7 B7 20 33
85C6:F3 9A 20 79 00 F0 10 20 22
85CE:FD AE D0 05 A9 FF A8 D0 6E
85D6:03 20 AB 99 20 F7 9A 20 C0
85DE:60 9A 20 AD 98 20 03 98 93
85E6:F0 2E A4 14 A5 15 C5 50 39
85EE:D0 02 C4 4F 90 EF C5 52 A2
85F6:D0 04 C4 51 F0 02 B0 E5 FF
85FE:20 42 9C 30 E0 20 9F 98 B0
8606:20 60 9A 20 AD 98 20 03 B3
860E:98 F0 05 20 42 9C 30 F6 32
8616:4C BF 98 20 9E B7 8A D0 18
861E:03 4C 48 B2 C9 03 B0 F9 B9
8626:A0 00 C9 01 F0 02 A0 FF AD
862E:84 02 D0 22 8D E3 9F 20 A5
8636:3E 9A 24 9D 30 17 20 52 E7
863E:9A A5 7A A6 7B 8D E4 9F 47
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8E46:8E E5 9F A5 39 A6 3A 8D D8
8E4E:E6 9F 8E E7 9F 60 24 9D 7B
8E56:30 FB AD E3 9F C9 01 D0 75
8E5E:20 8E E3 9F 20 F5 98 AD 5D
8E66:E4 9F AE E5 9F 85 7A 86 A0
8E6E:7B AD E6 9F AE E7 9F 85 65
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9436:9F 30 9D C9 59 D0 99 A2 6F
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962E:20 79 00 F0 14 20 FD AE A4
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9BF6:20 CA 30 05 20 47 AB D0 8D
9BFE:F8 68 AA 60 A5 7A A4 7B 04
9C06:8D F9 9F 8C FA 9F A5 39 1C
9C0E:A4 3A 24 9D 10 03 A9 FF 66
9C16:A8 8D FC 9F 8C FD 9F A9 E5
9C1E:01 8D F6 9F 60 8C D1 9F 8C
9C26:8D D2 9F 84 FD 85 FE 4C 67
9C2E:DA 97 A0 00 A9 A0 20 23 02
9C36:9C A0 FF A9 BF 8C D3 9F F7
9C3E:8D D4 9F 60 20 B6 98 20 9A
9C46:60 98 4C 84 98 20 A3 9C D0
9C4E:8D F4 9F 20 92 9C AE D8 BE
9C56:9F A0 00 20 BA FF 20 C1 61
9C5E:E1 AE F4 9F 20 1E E1 20 2A
9C66:12 E1 20 12 E1 A0 00 A9 81
9C6E:FC 85 0B 20 12 E1 99 FC 33
9C76:01 F0 0B E6 0B A5 90 D0 1D
9C7E:0C C8 C0 59 90 ED A5 0B 30
9C86:30 F1 A5 0B 60 29 BF F0 D1
9C8E:F9 4C 9C E1 48 20 C3 FF D3
9C96:68 60 8A A2 D0 A0 02 20 C4
9C9E:BD FF 4C 72 9B 20 08 9B 70
9CA6:F0 1C 86 22 84 23 AA A8 01
9CAE:88 B1 22 99 D0 02 88 10 26
9CB6:F8 C8 B9 67 9F 9D D0 02 63
9CBE:F0 05 E8 C8 D0 F4 AA 4C 57
9CC6:98 9C 20 79 00 F0 09 C9 AE
9CCE:2C F0 05 20 73 00 D0 F7 32
9CD6:60 A9 0B A2 00 8D 20 D0 7D
9CDE:8E 21 D0 A2 01 8E 86 02 3D
9CE6:60 48 8A 48 98 48 20 ED 4C
9CEE:F6 D0 0C 20 A3 FD 20 5B 0C
9CF6:FF 20 D7 9C 6C 02 A0 68 12
9CFE:A8 68 AA 68 40 53 8B 64 4D
9D06:8B 60 88 69 89 B5 8B 72 73
9D0E:8A 09 05 15 0D 1D 19 01 D2
9D16:11 06 16 0E 1E 04 14 0C 34
9D1E:1C 5F 20 3D 20 24 00 0D B5
9D26:12 4C 41 42 45 4C 20 46 AB
9D2E:49 4C 45 3A 0D 0D 00 4C 56
9D36:41 42 45 4C 00 20 44 45 5E
9D3E:46 49 4E 45 44 2E 0D 00 02
9D46:12 45 4E 44 20 4F 46 20 D4
9D4E:50 41 53 53 20 00 53 54 9D
9D56:41 52 54 49 4E 47 20 41 F6
9D5E:44 44 52 45 53 53 00 45 98
9D66:4E 44 49 4E 47 20 41 44 69
9D6E:44 52 45 53 53 00 44 49 AA
9D76:53 CB 46 49 4E C4 4C 41 0B
9D7E:42 45 CC 50 41 53 D3 53 1D
9D86:45 D4 52 45 4E 55 CD 41 DC
9D8E:55 54 CF 44 45 CC 4F 4C 10
9D96:C4 57 52 49 54 C5 44 49 74
9D9E:D2 50 55 D4 41 46 46 49 48
9DA6:D8 48 45 4C D0 4C 46 D4 E6
9DAE:44 4C 49 53 D4 4D 45 52 36
9DB6:47 C5 41 44 C3 41 53 CC 0A
9DBE:42 43 C3 42 43 D3 42 45 BB
9DC6:D1 42 49 D4 42 4D C9 42 0F
9DCE:4E C5 42 50 CC 42 52 CB CF
9DD6:42 56 C3 42 56 D3 43 4C 3A
9DDE:C3 43 4C C4 43 4C C9 43 C4
9DE6:4C D6 43 4D D0 43 50 D8 48
9DEE:43 50 D9 44 45 C3 44 45 66
9DF6:D8 44 45 D9 45 4F D2 49 4C
9DFE:4E C3 49 4E D8 49 4E D9 C2
9E06:4A 4D D0 4A 53 D2 4C 44 3D
9E0E:C1 4C 44 D8 4C 44 D9 4C C8
9E16:53 D2 4E 4F D0 50 48 C1 8A
9E1E:50 48 D0 50 4C C1 50 4C 0B
9E26:D0 52 4F CC 52 4F D2 52 DE
9E2E:54 C9 52 54 D3 53 42 C3 CB
```

```
9E36:53 45 C3 53 45 C4 53 45 45
9E3E:C9 53 54 C1 53 54 D8 53 CC
9E46:54 D9 54 41 D8 54 41 D9 37
9E4E:54 53 D8 54 58 C1 54 58 B5
9E56:D3 54 59 C1 42 59 D4 4F 4A
9E5E:50 DA 57 4F D2 42 55 C6 6B
9E66:57 52 D4 42 41 D3 46 4C D4
9E6E:D0 00 49 8C A4 8C 34 8D 53
9E76:18 8E AA 8E CA 8E 1B 8F F7
9E7E:2C 8F 5A 8F 94 8F B4 8F D5
9E86:80 90 16 91 48 91 99 91 51
9E8E:AF 91 B2 91 26 93 44 94 14
9E96:CA 92 CE 92 D2 92 98 94 87
9E9E:D6 92 DA 92 DE 92 5E 92 01
9EA6:E2 92 E6 92 62 92 66 92 BC
9EAE:6A 92 6E 92 31 93 B2 94 8E
9EB6:B6 94 48 94 72 92 76 92 24
9EBE:35 93 4C 94 7A 92 7E 92 FB
9EC6:DE 94 FA 94 39 93 4E 95 8B
9ECE:54 95 50 94 82 92 86 92 EC
9ED6:8A 92 8E 92 92 92 54 94 15
9EDE:58 94 96 92 9A 92 4B 93 B2
9EE6:9E 92 A2 92 A6 92 4F 93 47
9EEE:13 95 19 95 AA 92 AE 92 27
9EF6:B2 92 B6 92 BA 92 BE 92 62
9EFE:B4 95 17 96 47 96 68 96 44
9F06:D7 96 ED 96 01 97 4F 55 58
9F0E:54 20 4F 46 20 4C 41 42 C4
9F16:45 4C 20 4D 45 4D 4F 52 34
9F1E:D9 4C 41 42 45 4C 20 4E 93
9F26:4F 54 20 46 4F 55 4E C4 BB
9F2E:4C 41 42 45 4C 20 41 4C 32
9F36:52 45 41 44 59 20 45 58 8A
9F3E:49 53 54 D3 42 52 41 4E EA
9F46:43 48 20 54 4F 4F 20 4C C6
9F4E:4F 4E C7 44 49 52 45 43 67
9F56:54 20 4D 4F 44 45 20 4F 2D
9F5E:4E 4C D9 20 46 49 4C 45 4A
9F66:00 2C 50 2C 52 00 3F 5A E8
9F6E:45 52 4F 20 56 41 4C 55 76
9F76:45 00 3F 5A 45 52 4F 20 18
9F7E:41 44 44 52 45 53 53 00 3B
9F86:11 05 42 41 53 53 45 4D AB
9F8E:20 2D 20 54 48 45 20 42 4C
9F96:41 53 49 43 20 41 53 53 A8
9F9E:45 4D 42 4C 45 52 0D 0D 7B
9FA6:20 20 43 4F 50 59 52 49 31
9FAE:47 48 54 20 31 39 39 30 41
9FB6:20 43 4F 4D 50 55 54 45 5B
9FBE:21 20 50 55 42 4C 49 43 0F
9FC6:41 54 49 4F 4E 53 0D 0D C0
9FCE:00 00 C0 00 A0 FF BF 80 2B
9FD6:00 08 08 00 00 00 00 00 19
9FDE:00 00 00 00 00 00 00 00 1E
9FE6:00 00 00 00 00 00 00 00 26
9FEE:00 00 00 00 00 00 00 00 2E
9FF6:00 00 00 00 00 00 00 00 36
9FFE:00 00 00 00 00 00 00 00 3E
```

Directory Example

```
DQ 10 ' COPYRIGHT 1990 COMPUTE
      ! PUBLICATIONS, INC. - A
      LL RIGHTS RESERVED
XB 20 'DIRECTORY (BASSEM)
GD 30 INPUT# $A000,$B000:=USR
      {SPACE}1,0:=SQR 1
MP 40 =USR 1,0:' NO WARNINGS F
      OR ZEROS
CA 50 =SQR 1:' WRITE TO MEMORY
QR 60 'WRITE "DIR.ML,P,W":'CRE
      ATE ML FILE
DE 70 =RND $C000:' START ADDRE
      SS
SD 80 DATA 1
KG 90 '
FH 100 >SETLFS=65466
GB 110 >SETNAM=65469
MQ 120 >OPEN=65472
RQ 130 >CHKIN=65478
AB 140 >CHRIN=65487
PK 150 >CHROUT=65490
HS 160 >CLOSE=65475
PC 170 >CLRCHN=65484
QJ 180 >ZP=251
SM 190 >LINPRT=48589
EJ 200 '
PB 210 =CLR #1
RM 220 =CMD #8:' DEVICE NUMBER
XQ 230 =SYS #0
BC 240 =LIST >SETLFS
MB 250 =CLR #2:' LENGTH OF FIL
      ENAME
HR 260 =CMD #<>FILENM:' NAME I
      S "$0" FOR DIRECTORY
GH 270 =SYS #>>FILENM
QJ 280 =LIST >SETNAM
QF 290 =LIST >OPEN
GA 300 =CMD #1:' INPUT FROM FI
      LE 1
KR 310 =LIST >CHKIN
AQ 320 =LIST >CHRIN:' DISCARD
      {SPACE}TRACK AND SECTOR
       BYTES
QC 330 =LIST >CHRIN
DF 340 >NEWENT =LIST >CHRIN
SR 350 =/ >ZP
JE 360 =LIST >CHRIN
GJ 370 ORA >ZP:' CHECK FOR TWO
       CONSECUTIVE ZEROS INDI
      CATING LAST ENTRY
FH 380 =INPUT# >EXIT
MM 390 =CLR #13:' PRINT <CR> F
      OR EACH ENTRY
FD 400 =LIST >CHROUT
RS 410 >PAUSE =CLR 653:' SHIFT
       KEY PAUSE
CG 420 AND #1
DS 430 =READ >PAUSE
SQ 440 =LIST >CHRIN:' GET LOW
      {SPACE}BYTE
QF 450 =OR
CF 460 =LIST >CHRIN:' GET HIGH
       BYTE
ER 470 =LIST >LINPRT:' PRINT T
      HE NUMBER OF BLOCKS
MM 480 =CLR #32:' INSERT A SPA
      CE
KF 490 =LIST >CHROUT
XK 500 >LOOP =LIST >CHRIN
PP 510 =INPUT# >NEWENT:' ZERO
      {SPACE}BYTE ENDS AN ENT
      RY
JM 520 =LIST >CHROUT
RQ 530 =READ >LOOP:' LOOP BACK
       FOR MORE
CA 540 >EXIT =CLR #1:' ALL DON
      E, CLOSE AND RESET CHAN
      NELS
BA 550 =LIST >CLOSE
KB 560 =LIST >CLRCHN
HA 570 =NOT
MQ 580 >FILENM =ABS "$0"
CC 590 DATA 2
```

Screen Saver Example

```
HK 10 'COPYRIGHT 1990 COMPUTE!
       PUBLICATIONS, INC. ALL
      {SPACE}RIGHTS RESERVED.
QE 15 POKE 55,0:POKE56,32:CLR:
      ' RESERVE AREA ABOVE 819
      2
SD 20 SET $A000,$B000:OPZ 1,0:
      WRT 1
MC 30 'WRITE "SCR.BASS,P,W"
AG 40 BAS $2000
KK 42 PASS 1
AC 43 <T1=$A000:' STORAGE AREA
       UNDER ROM
PG 44 <T2=$A400
HQ 55 JMP <RECALL
MA 70 <STORE LDY #0:' ZERO LOO
      P COUNTER
PF 80 FOR I=0 TO 999:'REM INLI
      NE BASIC CODE
SD 90 LDA 1024+I:STA <T1+I
HM 95 LDA 55296+I:STA <T2+I
MH 100 NEXT
KG 110 RTS
PG 200 <RECALL LDA 1:PHA:AND #
       254:STA 1:' SWITCH TO R
       AM
XK 210 FOR I=0 TO 999:'REM INL
       INE BASIC CODE
SB 215 LDA <T1+I:STA 1024+I
MX 220 LDA <T2+I:STA 55296+I
MA 225 NEXT
QK 292 PLA:STA 1:RTS
EJ 999 PASS 2
```

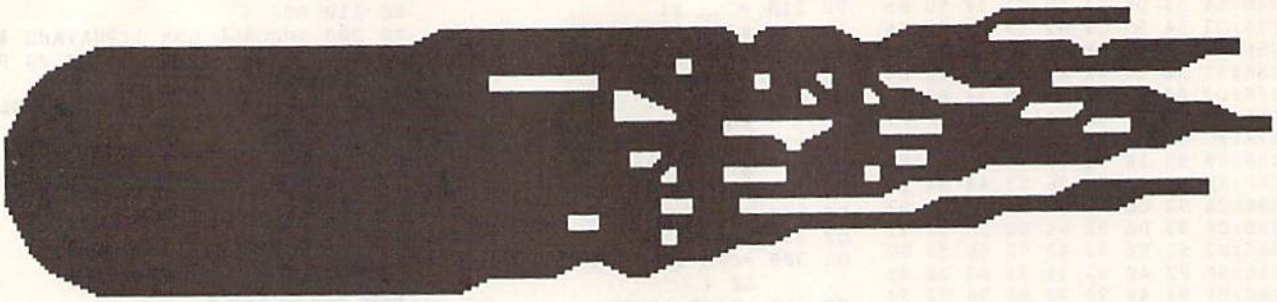
Split Source Part 1

```
DQ 10 ' COPYRIGHT 1990 COMPUTE
      ! PUBLICATIONS, INC. - A
      LL RIGHTS RESERVED
HJ 20 'SPLIT SOURCE PART ONE
RH 30 POKE45,0:POKE46,135:CLR:
      'RESERVE SPACE
DE 40 SET $A000,$BFFF:OPZ 1,0:
      WRITE "SPLIT,P,W":BAS $C
      000:PASS 1:<SET LDX #0
QX 50 STX $D021:DEX:STX $D020:
      LDX #3:<NEXTNUM LDA <END
      ,X:STA $22,X:DEX
ME 60 BPL <NEXTNUM:LDY #0:<WAI
      T LDX #1:<WAIT1 CPX 653:
      BNE <WAIT1
XK 70 <PRINT LDA ($22),Y:BEQ <
      JUMP:JSR $FFD2:INY:BNE <
      PR1:INC $23
CR 80 <PR1 CMP#" ":BNE <PRINT:
      <WAIT2 LDX 653:BNE <WAIT
      2:BEQ <WAIT
PA 90 <JUMP JMP ($24):<END PAS
      S 2
GK 100 LOAD"SPLITSRC.P2",8:'LO
       AD AND RUN NEXT PART
```

Split Source Part 2

```
DQ 10 ' COPYRIGHT 1990 COMPUTE
      ! PUBLICATIONS, INC. - A
      LL RIGHTS RESERVED
SS 20 'SPLIT SOURCE PART TWO
CE 30 BAS PEEK($FB)+256*PEEK($
      FC):'BAS BEFORE WRITE. B
      AS POINT TO THE LAST BYT
      E
DK 40 WRITE "SPLIT,P,A":'APPEN
      D TO ORIGINAL OBJECT COD
      E
FP 50 PASS 1:WOR <TEXT,<COLORS
HQ 60 <COLORS JSR <PRMSG:SEI:<
      LOOP FORI=0TO16:LDA #I:S
      TA $D020:NEXT
MH 70 'REPETITIVE INSTRUCTIONS
       MADE EASY WITH FOR-NEXT
       LOOPING
MX 80 FORI=1TO33:NOP:NEXT:JMP
      {SPACE}<LEAP:<LEAP LDA $
      DC01:CMP #239:BNE <LOOP:
      CLI:RTS
QA 90 <PRMSG LDX #0:<LP1 LDA <
      MSG,X:BEQ <RET:JSR $FFD2
      :INX:BNE <LP1:<RET RTS
PR 100 <MSG BYT 13,"{RVS}{YEL}
       PRESS SPACE",13,0
FA 110 <TEXT BYT 13,13,"{7}THI
       S IS AN EXAMPLE OF A PR
       OGRAM MADE OF TWO PARTS
       . "
HM 120 BYT "YOU CAN DO THIS WI
       TH PROGRAMS THAT WON'T
      {SPACE}FIT IN MEMORY IN
       ONE PART."
PJ 130 BYT 13," .....OK? ",0
PA 140 PASS 2
```

G



EXECUTION ANALYZER

John R. Hampton

Turn your 64 into a speed shop for BASIC programs. With the help of this runtime analyzer, you'll have your programs smoking in no time flat.

There are many tricks that speed up a BASIC program. You can use integer variables, shorten variable names, or move heavily used subroutines to the beginning of the program. But it's not always obvious just where in your program such changes would do the most good. What's needed is a way to locate the slowest parts of a program.

Execution Analyzer is a machine language routine that runs in the background while your BASIC program executes. As your program runs, *Analyzer* gathers valuable information about each line. When your program has finished, this information is compiled into

a runtime report that can help you pinpoint problem areas and streamline inefficient code.

Getting Started

Execution Analyzer consists of two programs. The first one, EX.BAS, is written in BASIC and is used to install *Analyzer*. To avoid typing errors, enter this program using *The Automatic Proofreader*, found elsewhere in this issue. When you've finished typing, be sure to save a copy of the program to disk.

The second program is written entirely in machine language (ML) and must be entered using *MLX*. The *MLX* prompts, and the values you should type in, are as follows:

Starting address: **A000**
Ending address: **A48F**

When you've finished typing in the data, save a copy of the program to disk as EX.ML. When you're ready to test a program, load and run EX.BAS. After the ML file has been loaded into memory, a list of options will be displayed.

Analyzing a Program

Execution Analyzer is controlled with four SYS commands, all of which must be used from program mode. The first, SYS 724,O, turns *Analyzer* on *(O* for *On)* and begins testing. The second command, SYS 724,F, turns *Analyzer* off *(F* for *oFf)*. The last two commands, SYS 724,D and SYS 724,P, output the results of the analysis to your screen *(D* for *Display)* or to your printer *(P* for *Print)*, respectively.

For a quick demonstration, load and run EX.BAS (if you haven't already done so); then type in and run the following short program.

```
AS 100 REM *** EXAMPLE PROGRAM
       FOR ***
KJ 110 REM *** EXECUTION ANALY
       ZER{2 SPACES}***
HJ 120 :
GP 130 SYS 724,O
CG 140 LOOPS=100
ME 150 FOR I=1 TO LOOPS
FP 160 PRINT"LOOP"I
GA 170 FOR D=1 TO 100:NEXT
XR 180 IF INT(I/2)=I/2 THEN 20
       0
RH 190 X=SQR(COS(SIN(TAN(↑↑2))
       ))
GM 200 GOSUB 230
AC 210 NEXT I
MB 220 SYS 724,F:SYS 724,D:END
XF 230 RESTORE:DATA 1,2,3,4,5
GD 240 FOR J=1 TO 5:READ A
DK 250 POKE 30000+J,A:NEXT:RET
       URN
```

This program doesn't do much; it simply contains a couple of loops and a subroutine that give *Analyzer* something to evaluate. Line 130 activates *Analyzer*, and line 220 turns it off and displays the results when the program has finished.

The accompanying table contains a runtime report based on the test program. The first item in the table, *PROGRAM RUNTIME*, shows the total time used to execute the test program. The remainder of the report is divided into five columns, each showing specific information about the program lines that are executed.

The first column, labeled *LINE#*, is the number of the line executed. Column 2, *EXECUTE*, shows the number of times that the line executes. Column 3, *TOTAL TIME*, gives the amount of time spent executing the line. The fourth column, *AVE SEC*, lists the average number of seconds used to execute the line. And the last column, *PRCNT*, is the percentage of total runtime used by the line.

If you were testing a program, you could use this information to see where your program spends most of its execution time. You could then make changes to the program and test it again to see if its performance had improved.

Generating a Report

When *Analyzer* is active, it tests every program line executed. Lines with INPUT and GET statements will greatly affect the runtime report because they depend on the speed of the user, not of the program. Hence, it's not really necessary to test these lines.

To avoid this problem, first decide which section of your program needs testing; then place the command SYS 724,O at the start of the section and SYS 724,F at the end. *Analyzer* will test and report only on the lines between these two commands. This way, you can turn off *Analyzer* prior to INPUT or GET statements, and then turn it back on afterward. If your program executes an END or a NEW while being tested, *Analyzer* turns itself off automatically.

When *Analyzer* generates a report, the lines are listed in the order in which they're executed. Because of GOTOs and GOSUBs, this list may not be in numerical order. There are six additional SYS commands available to you that will sort a report before displaying or printing it.

SYS 724,DL **(Sort by line number)**
SYS 724,PL

SYS 724,DE **(Sort by number of executions)**
SYS 724,PE

SYS 724,DT **(Sort by total time)**
SYS 724,PT

The last sort option has the effect of sorting the line numbers by the percentage of program runtime, listing the fastest lines at the top and the slowest at the bottom. The resulting report is especially convenient for locating the most inefficient lines in your program.

Interpreting Test Results

If you run *Analyzer* several times in a row on the same program, you'll notice that the results vary slightly from one run to the next. This inherent error is due to the timing methods used by *Analyzer* itself and is exaggerated by evaluating short, quick program lines.

One way around this is to place a line of the test program that you wish to improve within an extended FOR-NEXT loop. The longer the program spends executing this line, the more accurate and precise the test results will be. The *EXECUTE* column can keep track of up to 8,388,607 iterations per program line, and the *TOTAL TIME* can extend well beyond 77 hours. So feel

Sample Runtime Report

*PROGRAM RUNTIME = 00:00:03

LINE#	EXECUTE	TOTAL TIME	AVE SEC	PRCNT
130	1	00:00:00.0	.0000	.00
140	1	00:00:00.0	.0000	.00
150	1	00:00:00.0	.0000	.00
160	100	00:00:04.6	.0458	12.97
170	100	00:00:12.4	.1237	34.98
180	100	00:00:01.0	.0103	2.92
190	50	00:00:10.3	.2070	29.28
200	100	00:00:00.1	.0012	.33
230	100	00:00:00.1	.0008	.24
240	100	00:00:02.0	.0203	5.75
250	500	00:00:04.6	.0092	13.06
210	100	00:00:00.2	.0017	.47
220	1	00:00:00.0	.0000	.00

free to let your program run overnight or even over the weekend.

Also, if you time the tests yourself, don't be surprised if the results don't correspond with times you get from your stopwatch. Programs generally run about 15 percent slower due to the overhead of *Analyzer* itself.

How It Works

The initialization routine for *Analyzer* occupies memory locations 724–767, while the bulk of the program is hidden under BASIC ROM beginning at location 40960. The program uses the timers in the CIA #2. Since this chip is also responsible for timing operations that involve certain I/O devices (the disk drive, printer, and user port), your test program cannot use these devices without affecting the results of the test.

When *Execution Analyzer* is turned on, it changes the BASIC vectors that normally point to a routine that decodes and executes commands. Whenever a BASIC command is encountered, a routine inside *Analyzer* takes over. As each line is executed, this routine records the amount of execution time used and increments a counter that holds the number of times each line is executed. Before a report is generated, this information is used to calculate the *AVE SEC* and *PRCNT* columns.

To save a little memory space, *Analyzer* does not check for syntax errors in the SYS commands. If an illegal command is given, it's simply ignored.

EX.BAS

```
HQ 10 REM COPYRIGHT 1990 COMPU
      TE! PUBLICATIONS, INC. -
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CF 20 IFA=0THENA=1:LOAD"EX.ML"
      ,8,1
GQ 30 PRINT"{CLR}":POKE53280,1
      2:POKE53281,0
QG 40 FORI=724TO767:READA:X=X+
      A:POKEI,A:NEXT:IFX<>3764
      THENPRINT"DATA ERROR.":S
      TOP
SB 50 PRINT"{CLR}{5}{RVS}
      {6 SPACES}EXECUTION ANAL
      YZER INSTALLED{6 SPACES}
      "
SH 60 PRINT"{4}{2 SPACES}{RVS}
       COMMAND{8 SPACES}FUNCTI
      ON{12 SPACES}":PRINT
GH 70 PRINT"{5}{2 SPACES}SYS 7
      24,0{6 SPACES}TURN ANALY
      ZER ON ":PRINT
AG 80 PRINT"{2 SPACES}SYS 724,
      F{6 SPACES}TURN ANALYZER
       OFF ":PRINT:PRINT
EF 90 PRINT"{4}{2 SPACES}{RVS}
      {7 SPACES}DISPLAY OR PRI
      NT REPORT{6 SPACES}":PRI
      NT
HA 100 PRINT"{5}{2 SPACES}SYS
      {SPACE}724,D{6 SPACES}B
      Y ORDER OF EXECUTION":P
      RINT"{2 SPACES}SYS 724,
      P":PRINT
MB 110 PRINT"{2 SPACES}SYS 724
      ,DL{5 SPACES}BY LINE NU
      MBER":PRINT"{2 SPACES}S
      YS 724,PL":PRINT
FE 120 PRINT"{2 SPACES}SYS 724
      ,DE{5 SPACES}BY # OF EX
      ECUTIONS":PRINT"
      {2 SPACES}SYS 724,PE":P
      RINT
JA 130 PRINT"{2 SPACES}SYS 724
      ,DT{5 SPACES}BY TOTAL T
      IME":PRINT"{2 SPACES}SY
      S 724,PT":NEW
XM 140 DATA 32,246,2,32,0,160,
      72,165,1,9,1,133,1,88,1
      04,96,32,246,2,32,155,1
      61
FS 150 DATA 32,218,2,76,228,16
      7,32,218,2,32,0,0,72,12
      0,165,1,41,254,133,1,10
      4,96
```

EX.ML

```
A000:20 73 00 AA 20 73 00 E0 88
A008:4F F0 31 E0 46 F0 4F E0 D6
A010:44 F0 56 E0 50 D0 51 A9 9A
A018:FF A2 04 A8 20 BA FF 20 19
A020:C0 FF A2 FF 20 C9 FF 20 5E
A028:69 A0 D0 08 A2 05 20 BE 09
A030:A3 CA D0 FA A9 FF 20 C3 11
A038:FF 4C CC FF A2 04 A9 00 9E
A040:85 A9 9D 85 A4 CA 10 FA 26
A048:8E 06 DD 8E 07 DD A9 95 8F
A050:8D 04 DD A9 42 8D 05 DD DF
A058:20 B3 A1 A9 02 2C A9 A7 21
A060:8D 09 03 A9 E4 8D 08 03 16
A068:60 A0 FF 20 79 00 F0 15 C6
A070:AA 20 73 00 C8 E0 4C F0 D0
A078:0C A0 02 E0 45 F0 06 A0 D0
A080:05 E0 54 D0 E3 84 BD A2 63
A088:00 20 9A A3 20 45 A3 20 DC
A090:04 A3 A2 15 20 9A A3 A0 B5
A098:04 BE 3E A4 20 BB A3 A9 7E
A0A0:2D 20 D2 FF CA D0 F8 88 EE
A0A8:10 EF 20 A0 A3 A0 04 B1 55
A0B0:F7 29 7F 91 F7 20 83 A3 2C
A0B8:D0 F3 20 BE A3 20 E4 FF B6
A0C0:C9 20 F0 A4 20 A0 A3 20 42
A0C8:83 A3 F0 9C A0 04 B1 F7 0D
A0D0:30 F5 A5 F7 85 F9 A5 F8 34
A0D8:85 FA A5 BD 30 33 20 83 3E
A0E0:A3 F0 2E A0 04 B1 F7 30 07
A0E8:F5 A4 BD B1 F9 38 F1 F7 AD
A0F0:85 57 C8 B1 F9 F1 F7 85 0C
A0F8:58 08 C0 01 F0 07 28 C8 4D
A100:B1 F9 F1 F7 08 28 90 D6 31
A108:05 58 05 57 D0 C4 A8 F0 D5
A110:DA A0 01 B1 F9 48 88 B1 D7
A118:F9 A8 68 20 6B A3 A2 06 C6
A120:20 5B A2 20 33 A3 A2 08 16
A128:20 5B A2 20 D5 A3 20 A9 CF
A130:A3 20 01 A4 20 EE A3 20 DB
A138:04 A4 20 21 A4 20 1B A4 3D
A140:08 20 CE A3 28 F0 0B 20 DE
A148:18 A4 A0 1E 20 E7 A3 20 BE
A150:F4 A3 20 04 A3 20 CE A3 1A
A158:20 A9 A3 A2 01 8A 20 5D 84
A160:A2 20 D5 A3 20 33 A3 20 27
A168:DD A3 20 0B A4 20 C3 A3 09
A170:A2 07 A9 04 20 5D A2 20 18
A178:D5 A3 20 45 A3 20 DD A3 E4
A180:20 0B A4 20 01 A4 20 01 09
A188:A4 A2 05 A9 02 20 5D A2 EF
A190:A0 04 B1 F9 09 80 91 F9 62
A198:4C BA A0 A0 00 8C 0E DD FA
A1A0:C5 7A D0 06 B1 7A C5 3A 1D
A1A8:F0 04 A4 A9 F0 1F 84 A9 4B
A1B0:20 EC A1 A5 39 8D 83 A4 79
A1B8:A5 3A 8D 84 A4 A9 51 8D 53
A1C0:0F DD A5 A9 D0 03 20 1A 3F
A1C8:A2 A9 00 85 A9 A0 01 B1 A3
A1D0:7A C9 82 F0 0F C9 8E F0 D0
A1D8:0B C9 80 F0 04 C9 A2 D0 90
A1E0:05 4C 5E A0 E6 A9 A9 01 C1
A1E8:8D 0E DD 60 20 2D A2 A9 DC
A1F0:00 48 A0 04 18 AD 06 DD FB
A1F8:49 FF AA 20 27 A2 AD 07 5E
A200:DD 49 FF 48 20 27 A2 20 0E
A208:25 A2 8A 48 A2 FD 18 68 04
A210:7D 88 A3 9D 88 A3 E8 D0 F9
A218:F6 60 20 2D A2 18 98 20 8E
A220:27 A2 20 25 A2 A9 00 C8 7C
A228:71 F7 91 F7 60 20 A0 A3 3E
A230:20 83 A3 F0 11 B1 F7 CD F6
A238:84 A4 D0 F4 88 B1 F7 CD 1B
A240:83 A4 F0 0B D0 EA A0 09 BB
A248:A9 00 91 F7 88 D0 FB AD 41
A250:83 A4 91 F7 C8 AD 84 A4 DC
A258:91 F7 60 A9 00 86 AA 85 FF
A260:AB 85 B4 F0 07 20 01 A4 E1
A268:C6 B4 D0 F9 20 EE A3 20 1C
A270:21 A4 20 28 A4 B9 00 01 03
A278:F0 05 85 B5 C8 D0 F6 88 83
A280:84 B6 88 D0 24 A5 AB F0 D3
A288:20 A5 B5 C9 30 D0 1A A5 39
A290:AA 38 E5 AB AA F0 06 20 F5
A298:BB A3 CA D0 FA 20 B8 A3 78
A2A0:A6 AB 20 B5 A3 CA D0 FA 68
A2A8:60 C8 C4 AB B0 02 A4 AB 26
A2B0:84 57 A5 AA 38 E5 57 AA 20
A2B8:A5 B6 38 E5 AB 85 B6 CA 8F
A2C0:30 06 20 BB A3 CA 10 FA C2
A2C8:A0 01 C4 AB D0 09 A5 B6 9E
A2D0:F0 05 C6 B6 C8 D0 14 A6 6C
A2D8:B6 CA 30 0B B9 00 01 20 D2
A2E0:D2 FF C8 C6 B6 D0 F5 A5 9F
A2E8:AB F0 18 20 B8 A3 A6 B6 9D
A2F0:F0 06 20 B5 A3 E8 D0 FA EC
A2F8:B9 00 01 F0 06 20 D2 FF A0
A300:C8 D0 F5 60 20 BB A3 20 FB
A308:1E A4 A0 00 84 5E 84 71 B3
A310:A0 06 84 5D A0 24 20 2F 94
A318:A4 A0 FA D0 05 A9 3A 20 A9
A320:D2 FF B9 06 00 20 D2 FF 8E
A328:B9 07 00 20 D2 FF C8 C8 01
A330:D0 EB 60 A0 02 B1 F9 48 04
A338:C8 B1 F9 48 C8 B1 F9 AA BF
A340:68 A8 4C 4F A3 AD 85 A4 E7
A348:AC 86 A4 AE 87 A4 48 8A F0
A350:20 6B A3 20 18 A4 A9 01 A0
A358:A0 00 20 E4 A3 20 FB A3 7B
A360:20 18 A4 68 A8 20 E7 A3 12
A368:4C F4 A3 20 E4 A3 20 1B 9A
A370:A4 10 22 20 76 A3 20 18 EE
A378:A4 A9 A5 A0 B1 20 0E A4 0A
A380:4C F1 A3 A5 F7 18 69 08 34
A388:85 F7 90 02 E6 F8 A0 00 1F
A390:B1 F7 C8 11 F7 60 20 D2 2D
A398:FF E8 BD 43 A4 D0 F7 60 BE
A3A0:A9 80 85 F7 A9 A4 85 F8 F0
A3A8:60 20 C3 A3 20 18 A4 20 A5
A3B0:21 A4 4C F1 A3 A9 30 2C AA
A3B8:A9 2E 2C A9 20 2C A9 0D 92
A3C0:4C D2 FF 20 18 A4 A0 3C B5
A3C8:20 E7 A3 4C 0B A4 A9 57 E8
A3D0:A0 00 4C 0E A4 A0 05 20 A4
A3D8:35 A3 4C 11 A4 A9 57 A0 59
A3E0:00 4C FE A3 A2 91 2C A2 AB
A3E8:A2 48 A9 B3 D0 46 A2 49 32
A3F0:2C A2 53 2C A2 6A 48 A9 1D
A3F8:B8 D0 39 A2 30 2C A2 8C 26
A400:2C A2 E2 2C A2 FE 48 A9 72
A408:BA D0 29 A2 12 2C A2 A2 5B
A410:2C A2 CA 48 A9 BB D0 1C EF
A418:A2 0F 2C A2 2B 2C A2 9B 11
A420:2C A2 CC 48 A9 BC D0 0C 34
A428:A2 DD 48 A9 BD D0 05 A2 BB
A430:68 48 A9 BE 8E F4 02 8D BA
A438:F5 02 68 4C F0 02 05 07 6F
A440:0A 07 05 0D 20 2A 50 52 5E
A448:4F 47 52 41 4D 20 52 55 4E
A450:4E 54 49 4D 45 20 3D 00 F8
A458:0D 0D 20 4C 49 4E 45 23 65
A460:20 45 58 45 43 55 54 45 C7
A468:20 54 4F 54 41 4C 20 54 D5
A470:49 4D 45 20 41 56 45 20 6A
A478:53 45 43 20 50 52 43 4E C7
A480:54 0D 00 00 00 00 00 00 37
A488:00 00 00 00 00 00 00 00 D1
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- Weight: 2-1/2" lbs.
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MAGNAPRINT

Want to add some variety to your text presentations? With *MagnaPrint*, you can. This machine language utility for the 64 offers you a choice of four character-set sizes, all of which can be used simultaneously. A demo is included.

Peter M. L. Lottrup

You've just put the finishing touches on your latest creation—a simple text-only program. You run it. It looks terrible; every screen is the same. If only there were some way to liven up the program's appearance. Here's where *MagnaPrint* comes in.

This short utility allows you to expand the current character set horizontally, vertically, or both horizontally and vertically. It works equally well with built-in or redefined character sets, and, since it expands only the characters that are displayed, it saves both time and memory.

Getting Started

Since *MagnaPrint* is written entirely in machine language, you'll need to type it in using *MLX*, the machine language entry program found elsewhere in this issue. When *MLX* prompts you, respond with the values given below.

Starting address: $CC00
Ending address: $CFF7

When you've finished entering the program, save it to disk as MAGNAPRINT.ML before you exit *MLX*.

The second program, Demo, is written in BASIC. To ensure accurate typing, enter it using *The Automatic Proofreader*, also located elsewhere in this issue. When you've finished, be sure to save a copy of the program to disk. To see *MagnaPrint* in action, load and run Demo.

Using *MagnaPrint*

To install *MagnaPrint* in your own programs, place the following line at the beginning of the program.

```
10 IF A=0 THEN A=1:LOAD
   "MAGNAPRINT.ML",8,1
```

Then, activate the routine by executing the command SYS 52224. You now have a choice of the following four character sizes.

- Size 0—the size of a standard Commodore character. *MagnaPrint* uses this size as its default.
- Size 1—double width (twice as wide as a standard character). Two bytes of screen memory are used for each character.
- Size 2—double height (twice the height of a standard character). Also uses two bytes per character.
- Size 3—double width and double height. Each character uses four bytes of screen memory.

The various character sizes are accessed by printing CHR$(X), where X is the size number, prior to printing the text. For example, the following lines print HELLO in four different sizes on the same screen line:

```
SYS 52224
PRINT"HELLO"CHR$(1)"HELLO"CHR$
  (2)"HELLO"CHR$(3)"HELLO"CHR$(0)
```

Notice the placement of CHR$(0) at the end of this line. This ensures that any printing performed thereafter will be done in standard-size characters.

MagnaPrint defines the enlarged characters in a buffer just before it prints them. To keep from overflowing the buffer, you should call the initialization routine (with SYS 52224) each time you clear the screen. This call effectively clears the character memory area, leaving it available for more expanded character definitions.

MagnaPrint lets you specify the character set that you wish to use and also lets you change character sets on the fly. To select a character set, POKE its high-byte address into location 52299 before you call the routine (with SYS 52224). By default, *MagnaPrint* uses the uppercase/graphics set (location 52299 contains a 208). To use the lower-/uppercase set, POKE a 216 into this location.

To use custom characters with *MagnaPrint*, call the routine with SYS 52224. Then, based on the screen codes of the characters that you wish to define, POKE the character definitions into memory beginning at 49152. This technique is illustrated in lines 320–410 of Demo. In line 380, the 8-byte definition for the @ character (screen code 0) is POKEd into memory. Suppose you wished to redefine the exclamation point (screen code 33) rather than @. Line 380 would become

```
380 L=49152+33*8:FORI=LTOL+7
   :READA:POKEI,A:NEXT
```

Note that you cannot display inverse characters with *MagnaPrint* by printing CHR$(18) before the characters. You can generate the inverse character-set definitions and print the resulting characters as if they were custom characters. Line 350 of Demo makes characters *A–L* (screen codes

Characters in all four text sizes appear on this screen from the demo program.

1–12) inverse and stores them in memory where the corresponding graphics characters would reside. So now, if you print SHIFT–A, an inverse *A* appears (see line 370 in Demo).

By default, *MagnaPrint* uses screen codes in the range 96–255 for storing enlarged characters (size 1–3 characters). But any screen-code range may be specified by using the following POKEs:

POKE 52256,*starting screen code*
POKE 52261,*ending screen code*

Finally, when you've finished using *MagnaPrint*, execute the command SYS 52227 to return the computer to its standard memory configuration.

Some Caveats

There are several things that you should bear in mind when using *MagnaPrint*. If the program runs out of memory in which to store the large character shapes, an OUT OF MEMORY error will occur and the program will stop. The only way to avoid this error is to SYS to the routine each time you clear the screen.

Control codes (cursor commands, color codes, and so on) don't have special significance within printed text unless you're using standard-size characters (size 0). So, to issue a control code within a line of enlarged text, switch to standard-size text using CHR$(0), print the control code, and then return to the prior text size with CHR$(*X*).

If you press RUN/STOP–RESTORE while the program is active, you'll be left on an alternate text screen. To return to the default screen, type (blindly) SYS 52227.

How It Works

When you call *MagnaPrint* with the command SYS 52224, it copies a selected character set into RAM at 49152–51199 ($C000–$C7FF) and locates the text screen at 51200–52223 ($C800–$CBFF). Then it redirects the CHROUT (PRINT) vector at 806 ($326) to itself.

Henceforth, whenever you print a character, the routine checks to see if the character should be expanded. If not, the character is printed normally. Otherwise, if the character has not yet been printed in the size specified, it's expanded, added to a control table at 57344 ($E000), and then printed. If the character already exists in the expanded form, it's simply taken from the table at 57344 and printed.

MagnaPrint

```
CC00:4C 16 CC A9 04 8D 88 02 E2
CC08:A9 15 8D 18 D0 A9 C7 8D 39
CC10:00 DD 20 8A FF 60 A9 08 AA
CC18:20 D2 FF A9 C0 85 FC A9 D0
CC20:60 8D BA 02 A9 FF 8D C7 F4
CC28:02 A9 E0 8D BB 02 8D 38 5B
CC30:CC A2 08 A9 00 A8 99 00 4A
CC38:E0 C8 D0 FA EE 38 CC CA FA
CC40:D0 F4 A9 00 8D B7 02 8D 91
CC48:B8 02 A9 D0 85 FE A9 00 7C
CC50:A8 85 FD 85 FB 85 02 8D 3F
CC58:B9 02 A2 08 78 A5 01 29 A9
CC60:FA 85 01 B1 FD 91 FB C8 0B
CC68:D0 F9 E6 FC E6 FE CA D0 2F
CC70:F2 20 B1 CC A9 C8 8D 88 A2
CC78:02 A9 93 20 D2 FF A9 00 DB
CC80:8D 00 DD A9 20 8D 18 D0 6F
CC88:A9 BB 8D 26 03 A9 CC 8D DF
CC90:27 03 A9 C0 85 FE A9 00 3B
CC98:85 FD AD BA 02 20 75 CD 1F
CCA0:A5 FD 85 FB A5 FE 85 FC 2E
CCA8:60 78 A5 01 29 F8 85 01 8E
CCB0:60 48 A5 01 09 07 85 01 C1
CCB8:58 68 60 C9 04 B0 02 85 AD
CCC0:02 8E C1 02 48 A5 02 F0 25
CCC8:04 C9 04 90 04 68 4C CA 85
CCD0:F1 8C C0 02 68 8D BC 02 B3
CCD8:C9 20 90 F2 A0 00 84 FD AC
CCE0:A9 E0 85 FE 20 A9 CC B1 1B
CCE8:FD 20 B1 CC CD BC 02 D0 C2
CCF0:03 4C 0A CF 20 B1 CF 20 E4
CCF8:A9 CC B1 FD 20 B1 CC F0 03
CD00:09 20 B1 CF 20 B1 CF 4C 0F
CD08:E4 CC AD BB 02 85 FE A9 88
CD10:00 85 FD AC B8 02 AD BC 7D
CD18:02 91 FD 20 B1 CF A5 02 F4
CD20:91 FD 20 B1 CF AD BA 02 CF
CD28:91 FD 20 B1 CF 8C B8 02 4F
CD30:A5 FE 8D BB 02 AC BA 02 06
CD38:C8 CC C7 02 F0 1E C8 CC E2
CD40:C7 02 F0 18 A5 02 C9 03 AB
CD48:D0 0C C8 CC C7 02 F0 0C 69
CD50:C8 CC C7 02 F0 06 8C BA 10
CD58:02 18 90 09 A9 00 85 02 F7
CD60:A2 10 6C 00 03 A9 C0 85 A4
CD68:FE AD BC 02 20 BD CE 20 5C
CD70:75 CD 4C A7 CD 48 0A 0A EB
CD78:0A 85 FD 68 C9 20 90 26 D6
CD80:E6 FE C9 40 90 20 E6 FE 5E
CD88:C9 60 90 1A E6 FE C9 80 1C
CD90:90 14 E6 FE C9 A0 90 0E 46
CD98:E6 FE C9 C0 90 08 E6 FE 1E
CDA0:C9 E0 90 02 E6 FE 60 A9 29
CDA8:00 8D BE 02 A5 02 C9 02 6A
CDB0:D0 03 4C 88 CF A2 08 A5 46
CDB8:02 C9 03 D0 1D A5 FC 8D 3C
CDC0:C5 02 A5 FB 8D C8 02 AD 75
CDC8:B7 02 8D C6 02 A9 02 85 1F
CDD0:FC A9 A7 85 FB A9 00 8D B6
CDD8:B7 02 AC B7 02 A9 00 91 2A
CDE0:FB AC BE 02 B1 FD 8D BF FD
CDE8:02 AC B7 02 29 80 F0 02 F6
CDF0:A9 C0 20 B5 CE 29 40 F0 7D
CDF8:02 A9 30 20 B5 CE 29 20 63
CE00:F0 02 A9 0C 20 B5 CE 29 2B
CE08:10 F0 02 A9 03 20 B5 CE 97
CE10:AD B7 02 18 69 08 8D B7 72
CE18:02 90 02 E6 FC A8 A9 00 67
CE20:91 FB AD BF 02 29 08 F0 EC
CE28:02 A9 C0 20 B5 CE 29 04 8A
CE30:F0 02 A9 30 20 B5 CE 29 9D
CE38:02 F0 02 A9 0C 20 B5 CE 09
CE40:29 01 F0 02 A9 03 20 B5 40
CE48:CE AD B7 02 38 E9 07 B0 F7
CE50:02 C6 FC 8D B7 02 EE BE 7B
CE58:02 CA F0 03 4C DA CD AD 0F
CE60:B7 02 18 69 08 8D B7 02 DB
CE68:90 02 E6 FC A5 02 C9 03 47
CE70:F0 03 4C DC CC A9 00 8D 39
CE78:BE 02 AD C8 02 85 FB A9 FF
CE80:A7 85 FD A9 02 85 FE AD 7F
CE88:C5 02 85 FC AD C6 02 8D 24
CE90:B7 02 AC BE 02 C0 10 B0 EF
CE98:D9 B1 FD AC B7 02 91 FB FE
CEA0:C8 D0 02 E6 FC 91 FB C8 74
CEA8:D0 02 E6 FC 8C B7 02 EE 12
CEB0:BE 02 4C 92 CE 11 FB 91 25
CEB8:FB AD BF 02 60 8D C3 02 9A
CEC0:29 80 8D C2 02 AD C3 02 41
CEC8:29 3F 8D C3 02 AD C2 02 07
CED0:F0 08 AD C3 02 09 40 8D 1D
CED8:C3 02 AD C3 02 60 8D C4 3C
CEE0:02 8D C3 02 29 40 8D C2 A3
CEE8:02 AD C3 02 29 3F C9 20 85
CEF0:B0 02 09 40 8D C3 02 AD B9
CEF8:C2 02 C9 40 D0 08 AD C3 7B
CF00:02 09 80 8D C3 02 AD C3 11
CF08:02 60 20 B1 CF 20 A9 CC FE
CF10:B1 FD 20 B1 CC D0 03 4C 23
CF18:01 CD C5 02 F0 03 4C 01 B1
CF20:CD 20 B1 CF 20 A9 CC B1 D4
CF28:FD 20 B1 CC 8D BD 02 AE E7
CF30:C1 02 20 DC CF A5 02 C9 E5
CF38:01 D0 06 20 DC CF 4C 5A 68
CF40:CF C9 02 D0 17 A9 11 AC B5
CF48:C0 02 20 CA F1 A9 9D 20 0B
CF50:CA F1 20 DC CF A9 91 20 0C
CF58:CA F1 18 60 EE BD 02 20 75
CF60:DC CF CE BD 02 CE BD 02 E0
CF68:A9 11 20 CA F1 A9 9D 20 63
CF70:CA F1 A9 9D 20 CA F1 20 31
CF78:DC CF EE BD 02 20 DC CF 4E
CF80:A9 91 20 CA F1 18 90 D2 ED
CF88:AC BE 02 C0 08 F0 1F B1 6E
CF90:FD 8D BF 02 AC B7 02 91 84
CF98:FB C8 D0 02 E6 FC 91 FB EC
CFA0:C8 D0 02 E6 FC 8C B7 02 13
CFA8:EE BE 02 4C 88 CF 4C DC 6D
CFB0:CC C8 D0 02 E6 FE 60 48 5F
CFB8:AD C4 02 C9 80 90 0B A9 43
CFC0:12 AC C0 02 20 CA F1 8C 69
CFC8:C0 02 68 60 A0 00 84 D4 3F
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CFD8:8C C0 02 60 AC C0 02 AD 4F
CFE0:BD 02 20 DE CE 20 B7 CF 08
CFE8:20 CA F1 20 CC CF 8C C0 0B
CFF0:02 EE BD 02 60 00 00 00 28
```

Demo

```
XQ 5 REM COPYRIGHT 1990 COMPUT
     E! PUBLICATIONS, INC. - A
     LL RIGHTS RESERVED
JH 10 IFPEEK(52224)<>76THENLOA
     D"MAGNAPRINT.ML",8,1
MC 20 LN$="*":FORI=1TO18:LN$=L
     N$+"*":NEXT
XB 30 SYS52224:POKE53280,0:POK
     E53281,0
KM 40 DIMV$(24):V$(0)="{HOME}"
     :FORI=1TO24:V$(I)=V$(I-1
     )+"{DOWN}":NEXT
XG 50 PRINTV$(2)TAB(15)"{BLU}C
     OMPUTE!'S"
QJ 60 PRINTV$(3)TAB(12)CHR$(1)
     "GAZETTE"
QG 70 PRINTV$(4)CHR$(0)TAB(9)"
     {RED}FOR"CHR$(1)"*******
     "CHR$(0)"USERS"
PQ 80 PRINTV$(5)CHR$(2)TAB(11)
     "COMMODORE 64/128"
MK 90 PRINTV$(9)TAB(15)CHR$(0)
     "{YEL}PRESENTS..."
MG 100 FORDY=1TO3000:NEXT
SJ 110 A$="MAGNAPRINT!"
QE 120 FORJ=1TO5:POKE646,J
FK 130 PRINTV$(12+J*2)TAB(9)CH
     R$(3);
EX 140 FORI=1TOLEN(A$):PRINTMI
     D$(A$,I,1);
GR 150 POKE54296,15:POKE54296,
     0:FORDY=1TO30:NEXTDY,I,
     J
CM 160 FORDY=1TO3000:NEXT
RF 170 PRINTCHR$(0)"{CLR}":SYS
     52224
BE 180 PRINTV$(5)TAB(4)"{3}"CH
     R$(3)"4 ";:POKE646,6
EB 190 PRINTCHR$(2)"TEXT SIZES
      FOR YOU TO USE!"
AG 200 PRINTV$(8)TAB(8)CHR$(0) ▷
```

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```
        "{CYN}{2 DOWN}STANDARD
        {SPACE}SIZE"
MQ 210  PRINTTAB(8)CHR$(1)"DOUB
        LE WIDTH"
RG 220  PRINTTAB(8)CHR$(2)"DOUB
        LE HEIGHT"
PP 230  PRINT:PRINTTAB(8)CHR$(3
        )"GIANT SIZE"
HX 240  GOSUB480:POKE52256,128:
        REM --- LIMIT REDEFD. C
        HARACTER RANGE ---
AR 250  PRINTCHR$(0)"{CLR}":SYS
        52224:PRINTCHR$(0)"
        {YEL}USE THE CHARACTER
        {SPACE}SET YOU WISH:"
AA 260  PRINTV$(8)"{BLU}"TAB(3)
        CHR$(1)"UPPERCASE/GRAPH
        ICS"V$(12)CHR$(1);:POKE
        646,2
SA 270  FORI=64TO96:PRINTCHR$(I
        );:NEXT:FORI=161TO187:P
        RINTCHR$(I);:NEXT
MP 280  FORDY=1TO2000:NEXT:POKE
        52299,216:PRINTCHR$(0)"
        {CLR}";
AD 290  SYS52224:PRINT"{YEL}USE
         THE CHARACTER SET YOU
        {SPACE}WISH:"
JD 300  PRINTV$(8)"{BLU}"TAB(2)
        CHR$(1)"LOWERCASE/UPPER
        CASE"V$(12)CHR$(1);:POK
        E646,2
PD 310  FORI=64TO96:PRINTCHR$(I
        );:NEXT:FORI=193TO219:P
        RINTCHR$(I);:NEXT
FC 320  FORDY=1TO2000:NEXT:POKE
        52256,91:POKE52299,208:
        PRINTCHR$(0)"{CLR}":SYS
        52224
HX 330  PRINT"{YEL}REVERSE AND
        {SPACE}CUSTOM CHARACTER
        S"
QQ 340  PRINT"ARE HERE TOO!{7}"
JE 350  FORI=49160TOI+96:POKE49
        672+KK,255-PEEK(I):KK=K
        K+1:NEXT
RC 360  FORI=0TO3:PRINTV$(I*2+4
        )TAB(7);:IFI=3THENPRINT
        "{DOWN}";
AD 370  PRINTCHR$(I)"ABCDEFGHIJ
        KL":NEXTI
CF 380  FORI=49152TOI+7:READA:P
        OKEI,A:NEXT
FB 390  DATA60,60,24,255,24,24,
        36,102
XG 400  PRINTV$(16)CHR$(0)"
        {RED}@ @ @{2 SPACES}"CH
        R$(1)"@ @ @{2 SPACES}"C
        HR$(2);
RM 410  PRINT"@ @ @{2 SPACES}"C
        HR$(3)"@ @ @"CHR$(0)
RQ 420  GOSUB480
QJ 430  POKE52256,96:PRINTCHR$(
        0)"{CLR}":SYS52224
DQ 440  PRINTV$(10)"{BLU}"CHR$(
        1)"PRESS "CHR$(0)"{UP}
        {RED}";
MF 450  PRINTCHR$(2)"ANY KEY "C
        HR$(0)"{BLU}"CHR$(1)"TO
         RESTART"
HB 460  POKE646,7:PRINTV$(14)TA
        B(8)CHR$(3)"MAGNAPRINT!
        "
JQ 470  POKE198,0:WAIT198,1:PRI
        NTCHR$(0)"{CLR}":RUN
JA 480  POKE646,7:PRINTV$(22)CH
        R$(1)LN$
CB 490  PRINTV$(23)TAB(6)"PRESS
         ANY KEY"
RH 500  PRINTV$(24)CHR$(1)LN$;C
        HR$(0)"{HOME}";
EQ 510  POKE198,0:WAIT198,1
EG 520  RETURN                  G
```

bug-swatter

● *Smart Disassembler* from the *Power Tools* disk and the January 1989 issue of *COMPUTE!'s Gazette* has a problem disassembling the STY instruction. The disassembler interprets $93 (147) as STY and $94 (148) as an unknown instruction (it prints BYTE $94). According to the *Commodore 64 Programmer's Reference Guide*, $93 is reserved for future expansion and $94 is the STY instruction. To correct the program, change line 1370 as follows:

```
1370 DATA STA,6,,,STY,7,STA,7,STX,12,
```

Reader David W. Spearing suggests the following changes to make labels stand out from the rest of the code when you disassemble to the screen.

```
750 IF LC(I)=AD THEN A$=S$+CHR$
    (158)+LB$(I)+CHR$(31):K=1
    :RETURN
```

● We've received several letters from readers who haven't been able to create a working copy of *SpeedScript 128 Plus* (September 1989). Other readers have written to tell us that they were successful. We aren't sure why some of you haven't been able to get the program to work, so we can only guess at a solution.

The first step in upgrading from *SpeedScript 128* to *SpeedScript 128 Plus* requires you to load the original program without running it. This step is important because *SpeedScript 128* modifies itself when you run it. If the version of *SpeedScript 128* that you have was run before it was saved, you won't be able to upgrade it. The only solution to this problem is to obtain a copy of the program that wasn't run before it was saved. *SpeedScript 128* is available on the October 1987 *Gazette Disk* and on the *SpeedScript* disk. You can also reenter it from the October 1987 issue.

Once you have a copy of *SpeedScript 128* that hasn't been run, upgrading it to *SpeedScript 128 Plus* is fairly easy. First, turn off your computer and then turn it back on. Next, place the disk containing *SpeedScript 128* into the disk drive and type

```
DLOAD"SPEEDSCRIPT 128"
```

Now, place the disk containing the patch program into the drive and type

```
BLOAD"SPEEDPATCH 128"
```

For the final step, place the disk that you want to store *SpeedScript 128 Plus* on into the drive and type

```
BANK 0:SYS 18212:BSAVE
  "SPEEDSCRIPT 128+",B0,P7169
  TO P17927:BANK 15
```

Reader Robert C. Countryman discovered some mistakes in Figure 1, "Sample Help Screen for Text-Editing Commands," from the *SpeedScript 128 Plus* article. The *RUN/STOP Insert 255 spaces* entry should read *Sh-R/S Insert 255 spaces* and the *Sh-R/S End Paragraph* entry should read *Sh-RET End Paragraph*. *SpeedScript 128 Plus* doesn't have a spelling checker built in, so the *CONTROL-C Check Spelling* entry should be removed.

● *Sound Sampler 64* (February 1990) doesn't print the correct values to enter into your own BASIC programs. To correct these problems, change lines 1120, 1130, and 1160.

```
1120 NEXT N2:PRINT#4,5+(N-1)*7;": ";Z
     (N,6)*16+Z(N,7)
1130 PRINT#4,6+(N-1)*7;": ";Z(N,8)*16
     +Z(N,9):NEXT N
1160 PRINT#4,23;": ";Z(4,5)*16+Z(4,6)
```

● Some readers have had trouble using the programs from the *GEOS Collection* disk. The instructions for using the disk are in the file, README, but *geoWrite* can't read the file. The problem stems from the fact that some of the *Collection* disks are write-protected. Any time a GEOS application, such as *geoWrite*, accesses a disk, it must be able to write temporary files to the disk. Since, the disk is write-protected, *geoWrite* can't read the README file.

The easiest way to correct the problem is to use a disk copier, such as *Turbo Copy* (April 1986), to copy the *Collection* disk to a blank disk. Once that's done, put your GEOS system disk into drive number 8 and type LOAD "GEOS",8,1. (GEOS 128 and GEOS 128 2.0 users can insert the GEOS system disk into disk drive 8 and then turn on their computer.) Once GEOS is running, put a disk containing *geoWrite* into the drive and click on the drive icon. Next, double-click on the *geoWrite* icon to run the program. (See your GEOS manual for more details on opening an application.) Now, insert your copy of the *GEOS Collection* disk into the disk drive, click on *geoWrite's* OPEN icon, and click on README. G

SPEED COLUMNS 2.0

Speed Columns (October 1988) added capabilities to *SpeedScript* such as multiple-column printing and full justification. Now, *Speed Columns* 2.0 adds even more features. These include formatting for facing pages, print queuing, and a scrolling preview feature.

Typing It In

Speed Columns 2.0 is written entirely in machine language. To enter it, use *MLX*, the machine language entry program found elsewhere in this issue. The *MLX* prompts, and the values you should enter, are as follows:

Starting address: 0801
Ending address: 1FC0

When you've entered all the data for the program, be sure to save a copy to disk before leaving *MLX*.

To get started, load and run the program as if it were a BASIC program. *Speed Columns* 2.0 (hereafter referred to simply as *Speed Columns*) displays a title screen for a few seconds, and then the main menu appears. The menu options are listed with their default values shown to the right of the option label. Each option has a letter shown in reverse video. To change any of the option values, simply press the key corresponding to the highlighted letter. Pressing the key by itself reduces the value. Pressing SHIFT along with the key increases the value.

Print Options

Following are the explanations of each of the menu options.

• **Program Disk.** Lets you choose the device number of the disk drive that contains *Speed Columns*. This is useful if you need to use a second disk drive with the program.

• **File Disk.** Lets you choose the device number for the disk drive containing the text and style-sheet files.

• **Printer.** Allows you to set the device number of your printer. The device number can be found in your printer manual.

Robert Bixby

Speed Columns, the multicolumn print formatter for *SpeedScript*, returns with several new commands and enhancements. For the 64 with a disk drive.

• **Second.** Allows you to specify the secondary address used when the printer channel is opened. Commodore printers use a secondary address of 7 (the default value) to print in upper-/lowercase mode. Some printer interfaces use a secondary address of 7 to indicate near-letter-quality (NLQ) mode. Check the manual that came with your printer or printer interface for more information.

• **Width.** Allows you to set the right margin of your printer. Width can range from 40 to 254. Most printers are limited to a line length of 80 in normal printing mode and 132 in condensed mode. Setting the width too large causes each line to wrap around to the beginning of the next line.

• **Length.** Lets you set the length of the paper as measured in lines. Length can range from 40 to 132 lines.

• **Margin.** Refers to the white space around the page and is measured horizontally by characters and vertically by lines.

• **Gutter.** Refers to the white space between columns. Gutter is measured in characters.

• **Columns.** Used to select the number of vertical columns on the page. Be careful with this setting. Printing your document in multiple columns can yield a very professional-looking document, but too many columns can make the page look cluttered. You can print 1–10 columns.

• **Facing pages.** Allows you to format pages as if you were printing a pamphlet. It lets you print two pages on a sheet of paper in such a way that you can fold the pages to form a booklet. Setting the facing-pages value to 1 turns off this option. A value of 2 sets it to print facing pages.

• **Preview.** Lets you select where your document prints. It has three settings: Print; Preview; and Preview, Print. Print sends the output to the printer. The printer device number is specified by the Printer option, above. Preview prints each page to a scrollable window. Use the cursor keys to move

around the window to examine the text; press ← to stop printing or RETURN to print the next page. Preview, Print prints each page to the preview window just as in Preview, but when you press RETURN it sends the page to the printer before printing the next page to the preview window. If you have a printer that allows you to print on single pages, you can use Preview, Print to simulate *SpeedScript*'s page-wait command.

• **Mast.** Allows you to print a section of text at the top of the first page, as in a masthead. The Mast value is the number of lines of text in the masthead plus the Margin value plus 5. For example, if you want to print a ten-line masthead at the top of your document and your margin setting is 5, you need to set Mast to 20 (10 lines + 5 margin + 5 = 20).

• **Running Head.** Lets you set the page header. It has three settings: Header/Page number, Header/No page number, No header/No page number. The header is the line of text printed at the top of each page (beginning with page 2). To enter the header, press H, type your text, and then press RETURN. Your header can contain up to 40 characters, but it may need to be shorter if you're using a narrow-width setting. Be sure to preview your page before printing to ensure that your header and page number are printing correctly.

Printing

Speed Columns has a print queue that can hold up to 15 files or 85 disk blocks. This means that you can select up to 15 files to print at a time. You can enter files into the print queue from the disk directory by pressing f5, or you can enter them manually by pressing f3.

When you press f5, the program prompts you for a search mask. If all your files start with CHAPTER, enter CHAPTER* as your search mask and press RETURN. If you want to select from all the files on the disk, enter * as the search mask. After you've entered the mask, *Speed Columns* displays each matching file. The filename is displayed in a numbered queue box that corresponds to its position within the queue. Use the up- and down-cursor keys to select the queue position; then press Y to place the file in the queue. If you don't want to print the file, press N. When you've seen all the matching files or the print queue is full, the program returns to the main menu. Press ← at any time to escape to the main menu.

If you press f3 to enter the filenames manually, the print-queue box appears with an arrow pointing to the current cursor location. Select the queue position using the cursor keys as above; then type the filename of the file to be printed and press RETURN. The drawback to entering filenames manually is that you can only enter alphanumeric characters. If you have a disk file whose name is %45..%0656!4%, you won't be able to enter it manually.

When you fill the print queue, either from the directory or manually, you don't have to worry about filling each slot in the queue. If you leave a blank in the queue, *Speed Columns* will ignore it.

Press f1 to start printing. *Speed Columns* loads the first file in the print queue, formats it, and then prints it to the preview window, the printer, or both.

More Features

If you find yourself using the same settings again and again, you need to save them in a style sheet. Adjust the settings in the menu to your liking and then press f8 to save them. The program prompts you for a filename (up to 14 characters). To help you differentiate between style sheets and text files, the file is saved with the reverse-on character at the beginning and the reverse-off character at the end of the filename. You don't have to type the extra characters when you load or save style sheets; *Speed Columns* takes care of them for you.

Finally, to exit *Speed Columns* at any time, press SHIFT–, CTRL–, or Commodore–RUN/STOP. Type RUN and press RETURN to reenter the program.

Speed Columns 2.0

```
0801:0B 08 FF FF 9E 32 32 38 F2
0809:38 00 EE 08 FF FF 8F 22 D4
0811:0D 0D 0D 0D 0D 0D 0D 0D 21
0819:0D 0D 0D 0D 0D 0D 0D 0D 29
0821:0D 0D 0D 0D 0D 0D 0D 0D 31
0829:20 20 20 20 20 20 20 20 39
0831:20 20 20 20 B0 C0 C0 C0 2A
0839:C0 C0 C0 C0 C0 C0 C0 C0 49
0841:C0 C0 C0 AE 0D 20 20 20 2E
0849:20 20 20 20 20 B0 C0 C0 7D
0851:C0 BD 43 4F 50 59 52 49 64
0859:47 48 54 20 31 39 38 39 C3
0861:AD C0 C0 C0 AE 0D 20 20 A6
0869:20 20 20 20 20 20 DD 43 18
0871:4F 4D 50 55 54 45 21 20 F5
0879:20 50 55 42 4C 49 43 41 CB
0881:54 49 4F 4E 53 DD 0D 20 29
0889:20 20 20 20 20 20 20 AD 27
0891:C0 C0 AE 33 32 34 20 20 FD
0899:57 2E 20 57 45 4E 44 4F 95
08A1:56 45 52 B0 C0 C0 BD 0D 15
08A9:20 20 20 20 20 20 20 20 B9
08B1:20 20 20 AD AE 47 52 45 35
08B9:45 4E 53 42 4F 52 4F 2C 1D
08C1:20 4E 43 B0 BD 0D 20 20 6B
08C9:20 20 20 20 20 20 20 20 D9
08D1:20 20 AD C0 C0 C0 C0 C0 07
08D9:C0 C0 C0 C0 C0 C0 C0 C0 E9
08E1:C0 BD 0D 0D 0D 0D 0D 0D F7
08E9:0D 0D 0D 0D 00 00 00 4C 82
08F1:30 0E 00 00 20 20 20 20 7F
08F9:20 20 20 20 20 20 20 20 0A
0901:20 20 20 20 00 00 20 20 91
0909:20 20 20 20 20 20 20 20 1B
0911:20 20 20 20 20 20 20 20 23
0919:20 20 20 20 20 20 20 20 2B
0921:20 20 20 20 20 20 20 20 33
0929:20 20 20 20 20 20 20 20 3B
0931:20 20 20 20 20 20 20 20 43
0939:20 20 20 20 20 20 20 20 4B
0941:20 20 20 20 20 20 20 20 53
0949:20 20 20 20 20 20 20 20 5B
0951:20 20 20 20 20 20 20 20 63
0959:20 20 20 20 20 20 20 20 6B
0961:20 20 20 20 20 20 20 20 73
0969:20 20 20 20 20 20 20 20 7B
0971:20 20 20 20 20 20 20 20 83
0979:20 20 20 20 20 20 20 20 8B
0981:20 20 20 20 20 20 20 20 93
0989:20 20 20 20 20 20 20 20 9B
0991:20 20 20 20 20 20 20 20 A3
0999:20 20 20 20 20 20 20 20 AB
09A1:20 20 20 20 20 20 20 20 B3
09A9:20 20 20 20 20 20 20 20 BB
09B1:20 20 20 20 20 20 20 20 C3
09B9:20 20 20 20 20 20 20 20 CB
09C1:20 20 20 20 20 20 20 20 D3
09C9:20 20 20 20 20 20 20 20 DB
09D1:20 20 20 20 20 20 20 20 E3
09D9:20 20 20 20 20 20 20 20 EB
09E1:20 20 20 20 20 20 20 20 F3
09E9:20 20 20 20 20 20 20 20 FB
09F1:20 20 20 20 20 20 20 20 04
09F9:20 20 20 20 20 20 20 20 0C
0A01:20 20 20 20 20 20 00 00 B4
0A09:00 00 00 00 00 00 00 00 1D
0A11:00 00 00 00 00 00 00 00 25
0A19:00 24 3A 20 20 20 20 20 61
0A21:20 20 20 20 20 20 20 20 35
0A29:20 20 20 20 20 20 20 20 3D
0A31:20 20 20 20 20 20 20 20 45
0A39:20 20 20 00 93 65 4E 54 8C
0A41:45 52 20 44 49 52 45 43 36
0A49:54 4F 52 59 20 53 45 41 55
0A51:52 43 48 20 4D 41 53 4B CB
0A59:3A 0D 00 6E 4F 20 4D 4F 99
0A61:52 45 20 46 49 4C 45 53 B1
0A69:20 4D 41 54 43 48 20 50 1A
0A71:41 54 54 45 52 4E 00 00 E5
0A79:00 08 00 92 70 12 52 4F 78
0A81:47 52 41 4D 20 64 49 53 43
0A89:4B 08 00 92 66 12 49 4C C8
0A91:45 20 64 49 53 4B 04 00 41
0A99:70 92 52 12 49 4E 54 45 67
0AA1:52 05 00 92 6D 12 41 52 D1
0AA9:47 49 4E 3C 00 92 6C 12 76
0AB1:45 4E 47 54 48 02 00 92 07
0AB9:67 12 55 54 54 45 52 50 A2
0AC1:00 92 77 12 49 44 54 48 D6
0AC9:07 00 92 73 12 45 43 4F 66
0AD1:4E 44 01 00 92 63 12 4F D3
0AD9:4C 55 4D 4E 53 00 00 6D FF
0AE1:41 53 92 54 12 01 00 66 FD
0AE9:41 43 49 4E 47 20 70 92 AB
0AF1:41 12 47 45 53 02 00 70 7B
0AF9:52 92 45 12 56 49 45 57 5F
0B01:70 52 49 4E 54 20 28 66 CB
0B09:31 20 54 4F 20 53 54 41 77
0B11:52 54 29 00 70 52 45 56 38
0B19:49 45 57 20 20 20 20 20 F3
0B21:20 20 20 28 66 31 29 00 20
0B29:70 52 45 56 49 45 57 2C 54
0B31:20 50 52 49 4E 54 20 28 76
0B39:66 31 29 01 00 72 92 55 48
0B41:12 4E 4E 49 4E 47 20 48 6A
0B49:45 41 44 6E 4F 20 68 45 D2
0B51:41 44 45 52 20 73 45 54 94
0B59:20 28 68 29 20 20 20 00 EA
0B61:68 45 41 44 2F 50 41 47 ED
0B69:45 20 4E 55 4D 42 45 52 99
0B71:20 20 20 20 20 20 00 6E 95
0B79:4F 20 48 45 41 44 2F 50 66
0B81:41 47 45 20 4E 55 4D 42 59
0B89:45 52 20 20 20 00 6E 4F 0A
0B91:20 48 45 41 44 2F 4E 4F 51
0B99:20 4E 55 4D 42 45 52 20 BE
0BA1:20 20 20 20 00 68 45 41 43
0BA9:44 2F 4E 4F 20 50 41 47 78
0BB1:45 20 4E 55 4D 42 45 52 E1
0BB9:20 20 20 00 00 52 45 44 04
0BC1:55 43 45 20 47 55 54 54 8A
0BC9:45 52 53 2C 20 4D 41 52 4F
0BD1:47 49 4E 53 2C 20 4F 52 AF
0BD9:20 43 4F 4C 55 4D 4E 53 4F
0BE1:21 00 00 63 4F 4C 55 4D 62
0BE9:4E 20 77 49 44 54 48 00 B6
0BF1:08 08 04 01 28 28 01 00 82
0BF9:01 01 01 01 00 00 0B 0B 22
```

Speed Columns 2.0

```
0C01:05 14 FE 84 0A FF 0A 02 2F
0C09:03 04 00 00 0F 0F 0F 0F 85
0C11:0F 0F 0F 0F 0F 0F 0F 0F 29
0C19:0F 0F 01 02 03 07 05 06 01
0C21:08 04 09 0A 0C 0E 0D 0B BD
0C29:7A 8A 97 A2 C0 AC B6 C9 2E
0C31:D3 E6 F6 3C DE F0 0A 0A 68
0C39:0A 0A 0A 0A 0A 0A 0A 0A 51
0C41:0A 0B 0A 0B 89 96 A1 AB A8
0C49:C8 B5 BF D2 DD F5 00 4B 6A
0C51:E5 EF 0A 0A 0A 0A 0A 0A D0
0C59:0A 0A 0A 0A 0B 0B 0A 0B 7E
0C61:00 00 00 93 12 68 65 61 11
0C69:64 65 72 20 65 72 72 6F A6
0C71:72 92 00 72 55 4E 4E 49 58
0C79:4E 47 20 48 45 41 44 20 EA
0C81:49 53 20 00 00 00 00 00 17
0C89:00 00 00 00 00 00 00 00 A1
0C91:00 00 00 00 00 00 00 00 A9
0C99:00 00 00 00 00 00 00 00 B1
0CA1:00 00 00 00 00 00 00 00 B9
0CA9:00 00 00 00 00 00 00 00 C1
0CB1:00 00 00 00 00 00 00 00 C9
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0F69:2D 0F B9 1B 0C 8D 2C 0F C8
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0F81:53 0C 85 FE 4C 0A 0F A9 3F
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13F1:8D 8A 0A 20 FA 13 4C E0 62
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1431:AD A2 0A A2 03 20 F6 0E D8
1439:8D A2 0A 20 45 14 20 16 E4
1441:16 4C E0 0E A0 03 4C 65 93
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1479:4C 7F 14 CE AC 0A AD AC AC
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1509:02 F0 06 EE DE 0A 4C 15 EC
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15B9:F6 0E 8D 3C 0B 20 C4 15 CF
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1681:07 AD F0 0B 4A 8D F0 0B E0
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1A59:20 97 1C 20 C6 1C C6 FC 3A
1A61:20 90 1C 20 D3 1B 20 E0 7B
1A69:1C D0 03 4C 3D 1A 20 AB 43
1A71:1C 20 C6 1C 4C 61 1A 20 92
1A79:A1 1A 20 D3 1C AD D3 0A 8F
1A81:8D FB 19 20 97 1C 20 90 9E
1A89:1C 20 D3 1B 20 E0 1C D0 8D
1A91:06 20 5D 1C 4C 78 1A 20 D6
1A99:AB 1C 20 D3 1C 4C 8A 1A 2D
1AA1:AD 8B 19 D0 16 A0 00 A9 9C
1AA9:30 99 72 1B C8 C0 0A 90 4A
1AB1:F6 A9 31 8D 7B 1B A9 02 68
1AB9:8D 8B 19 A9 00 85 FB AD 11
1AC1:A2 0A 4A 18 69 20 85 FC 68
1AC9:AD 3C 0B C9 03 D0 01 60 9F
1AD1:C9 02 F0 3E AD E6 0A C9 54
1AD9:01 F0 16 AD 7B 1B 29 01 04
1AE1:D0 0F AD C0 0A 38 ED A2 B3
1AE9:0A 38 ED C1 0C A8 4C F8 9F
1AF1:1A 20 7E 0E AC A2 0A A2 92
1AF9:00 BD 85 0C D0 03 4C 13 4D
1B01:1B 91 FB C8 E8 EC C1 0C BF
1B09:90 EF AD 3C 0B C9 04 D0 55
1B11:01 60 A2 09 FE 72 1B BD 7A
1B19:72 1B C9 3A 90 09 A9 30 58
1B21:9D 72 1B CA 4C 15 1B AD 6D
1B29:E6 0A C9 01 F0 1E AD 7B 75
1B31:1B 29 01 F0 11 20 ED 1C 6F
1B39:A8 A2 00 BD 72 1B C9 30 0C
1B41:D0 23 E8 4C 3C 1B 20 E7 01
1B49:1C 4C 50 1B AD C0 0A 38 19
1B51:ED A2 0A 38 E9 09 A8 A2 53
1B59:00 BD 72 1B C9 30 D0 05 B4
1B61:E8 C8 4C 5A 1B BD 72 1B 3D
1B69:91 FB C8 E8 E0 0A 90 F5 55
1B71:60 30 30 30 30 30 30 30 BF
1B79:30 30 30 13 20 20 20 20 EC
1B81:20 20 20 20 20 20 20 20 B7
1B89:20 20 20 20 20 20 20 20 BF
1B91:20 20 20 20 20 20 20 20 C7
1B99:20 20 20 20 20 20 20 20 CF
1BA1:20 20 20 20 13 42 55 46 88
1BA9:46 45 52 20 00 30 3A 00 D5
1BB1:00 00 00 00 00 00 00 00 E7
1BB9:00 00 00 00 00 00 00 00 EF
1BC1:00 00 10 20 30 40 50 60 7F
1BC9:70 80 90 A0 B0 C0 D0 E0 7F
1BD1:18 00 AD 87 1C F0 01 60 49
1BD9:20 A5 0E A0 00 B1 FD 20 38
1BE1:C3 0E C9 1F D0 06 20 13 9A
1BE9:1E 4C 47 1C AC F5 19 91 ED
```

Speed Columns 2.0

```
1BF1:FB EE F5 19 20 13 1E AD 69
1BF9:F5 19 CD F6 19 90 D3 CE 1C
1C01:F5 19 AC F5 19 CC FA 19 7A
1C09:B0 03 4C 2A 1C B1 FB C9 EF
1C11:20 F0 09 20 DE 1D CE F5 B7
1C19:19 4C 03 1C A9 20 91 FB FF
1C21:C8 CC F6 19 90 F8 4C 47 A9
1C29:1C EE F5 19 20 13 1E AC B1
1C31:F5 19 C8 CC F6 19 90 F1 BF
1C39:A0 01 B1 FD C9 20 D0 06 8E
1C41:20 13 1E 4C 39 1C AD FA 67
1C49:19 8D F5 19 E6 FC A5 FC 35
1C51:38 E9 20 CD F9 19 B0 03 99
1C59:4C D3 1B 60 AD F6 0A C9 3D
1C61:01 F0 07 C9 02 F0 09 20 D9
1C69:8E 16 20 8D 19 4C 74 1C 4A
1C71:20 8E 16 AD 87 1C F0 05 8E
1C79:68 68 4C 7F 1C 60 A9 93 CA
1C81:20 D2 FF 4C 0A 13 00 AD 8D
1C89:AC 0A 38 ED A2 0A 60 20 9E
1C91:88 1C 8D F9 19 60 AD A2 AE
1C99:0A 8D FA 19 8D F5 19 18 B9
1CA1:6D F0 0B 8D F6 19 EE F6 F7
1CA9:19 60 CE F6 19 AD F6 19 56
1CB1:18 6D B6 0A 8D FA 19 8D E0
1CB9:F5 19 18 6D F0 0B 8D F6 D2
1CC1:19 EE F6 19 60 AD DE 0A 34
1CC9:18 69 21 85 FC A9 00 85 F8
1CD1:FB 60 AD A2 0A 18 69 22 A5
1CD9:85 FC A9 00 85 FB 60 CE F4
1CE1:FB 19 AD FB 19 60 AD C0 3A
1CE9:0A 4A 18 60 20 E7 1C 6D 09
1CF1:A2 0A 60 AD E6 0A C9 01 D8
1CF9:D0 03 4C FC 19 A0 00 8C 8C
1D01:D2 1B 8C 8B 19 8C 87 1C DB
1D09:20 32 1E 20 7E 0E A9 25 4A
1D11:18 6D A2 0A 85 FC A9 00 1B
1D19:85 FB AD C0 0A 38 ED A2 86
1D21:0A 8D F6 19 20 ED 1C 8D B2
1D29:F5 19 8D FA 19 AD DE 0A 4D
1D31:8D F9 19 20 D3 1B 20 88 A9
1D39:1C CD DE 0A B0 06 20 5D AC
1D41:1C 4C 89 1D AD D3 0A C9 3A
1D49:01 D0 09 20 90 1C 20 D3 64
1D51:1B 4C 3F 1D AD D3 0A 8D 44
1D59:FB 19 20 ED 1C 20 9A 1C 6D
1D61:CE F6 19 CE F6 19 20 C6 F3
1D69:1C C6 FC 20 90 1C 20 D3 0E
1D71:1B 20 E0 1C D0 03 4C 3F 89
1D79:1D 20 AB 1C CE F6 19 CE D4
1D81:F6 19 20 C6 1C 4C 6C 1D F5
1D89:20 A1 1A 20 D3 1C AD D3 BF
1D91:0A 8D FB 19 AD 7B 1B 29 FF
1D99:01 F0 0F 20 ED 1C 20 9A 2F
1DA1:1C CE F6 19 CE F6 19 4C DE
1DA9:AE 1D 20 97 1C CE F6 19 23
1DB1:CE F6 19 20 90 1C 20 D3 3F
1DB9:1B 20 E0 1C D0 10 AD 7B 05
1DC1:1B 29 01 D0 03 4C 89 1D 7A
1DC9:20 5D 1C 4C 89 1D 20 AB 60
1DD1:1C CE F6 19 CE F6 19 20 E2
1DD9:D3 1C 4C B7 1D C6 FD A5 AF
1DE1:FD C9 FF D0 02 C6 FE A5 69
1DE9:FE C9 A4 B0 24 CE D2 1B D2
1DF1:AD D2 1B C9 FF D0 01 60 5D
1DF9:20 36 1E 90 0A A9 01 8D 25
1E01:87 1C 68 68 4C 7F 1C AD E1
1E09:F7 19 85 FD AD F8 19 85 21
1E11:FE 60 E6 FD D0 02 E6 FE FC
1E19:A5 FD CD F7 19 90 11 A5 B3
1E21:FE CD F8 19 90 0A 20 36 24
1E29:1E 90 05 A9 01 8D 87 1C 3D
1E31:60 20 27 1E 60 AC D2 1B E2
1E39:B9 07 0A 8D C1 1B D0 0C 56
1E41:EE D2 1B AD D2 1B C9 10 8E
1E49:90 EB 38 60 B9 C2 1B A8 8D
1E51:A2 00 EE D2 1B AD D2 1B 3A
1E59:C9 10 90 03 4C 4B 1E B9 46
1E61:07 09 9D B0 1B E8 C8 EC 1D
1E69:C1 1B 90 F3 20 29 1F AD 30
1E71:8A 0A AA A8 20 BA FF AD EE
1E79:C1 1B A2 B0 A0 1B 20 BD 2C
1E81:FF 20 C0 FF AE 8A 0A 20 B1
1E89:C6 FF A0 00 84 FD 8C 8C FE
1E91:19 A9 A4 85 FE 20 E4 FF F3
1E99:20 E4 FF 20 B7 FF 29 40 71
1EA1:D0 56 20 E4 FF 20 A5 0E 08
1EA9:AC 8C 19 91 FD 20 C3 0E A1
1EB1:C8 8C 8C 19 D0 E5 E6 FE 83
1EB9:A0 00 B9 7C 1B F0 06 20 0E
1EC1:D2 FF C8 D0 F5 A5 FE A2 74
1EC9:00 20 CD BD A9 20 20 D2 84
1ED1:FF A0 00 B9 B0 1B 20 D2 D6
1ED9:FF C8 CC C1 1B 90 F4 A0 A3
1EE1:00 B9 20 1F F0 06 20 D2 35
1EE9:FF C8 D0 F5 AE D2 1B A9 72
1EF1:00 20 CD BD A5 FE D0 A3 3A
1EF9:AD 8A 0A 20 C3 FF 20 3F 90
1F01:1F AD 6E 1F C9 30 F0 02 EC
1F09:38 60 AD 8C 19 8D F7 19 02
1F11:A5 FE 8D F8 19 A9 00 85 18
1F19:FD A9 A4 85 FE 18 60 20 E6
1F21:51 55 45 55 45 20 23 00 4C
1F29:A9 00 A2 00 A0 00 20 BD 93
1F31:FF A9 0F AE 8A 0A A0 0F 73
1F39:20 BA FF 4C C0 FF A2 0F 55
1F41:20 C6 FF 20 E4 FF 8D 6E F3
1F49:1F C9 30 F0 17 48 A9 93 5F
1F51:20 D2 FF 68 20 D2 FF 20 47
1F59:E4 FF C9 0D F0 03 4C 55 95
1F61:1F 20 9A 12 A9 0F 20 C3 39
1F69:FF 20 CC FF 60 00 70 52 7F
1F71:4F 47 52 41 4D 20 42 59 50
1F79:20 72 4F 42 45 52 54 20 AE
1F81:62 49 58 42 59 20 43 2F 73
1F89:4F 20 63 6F 6D 70 75 74 67
1F91:65 21 20 62 4F 4F 4B 53 96
1F99:33 32 34 20 77 2E 20 77 B2
1FA1:45 4E 44 4F 56 45 52 67 67
1FA9:52 45 45 4E 53 42 4F 52 84
1FB1:4F 2C 20 6E 2E 63 2E 20 09
1FB9:32 37 34 30 38 00 00 00 2A
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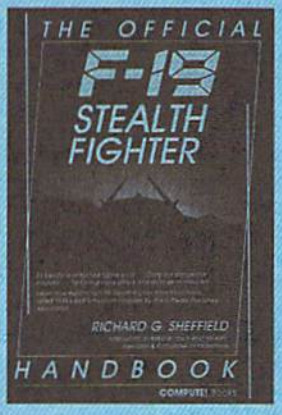

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The Automatic Proofreader

Philip I. Nelson

The Automatic Proofreader helps you type in program listings for the 128 and 64 and prevents nearly every kind of typing mistake.

Type in the *Proofreader exactly* as listed. Because the program can't check itself, type carefully to avoid mistakes. Don't omit any lines, even if they contain unusual commands. After you've finished, save a copy before running it.

Next, type RUN and press RETURN. After the program displays the message "Proofreader Active," you're ready to type in a BASIC program.

Every time you finish typing a line and press RETURN, the *Proofreader* displays a two-letter checksum in the upper left corner of the screen. Compare this result with the two-letter checksum printed to the left of the line in the program listing. If the letters match, it's almost certain the line was typed correctly. If not, check for your mistake and correct the line.

The *Proofreader* ignores spaces not enclosed in quotation marks, so you can omit or add spaces between keywords and still see a matching checksum. However, spaces inside quotes are almost always significant, so the program pays attention to them.

The *Proofreader* does *not* accept keyword abbreviations (for example, ? instead of PRINT). If you prefer to use abbreviations, you can still check the line by LISTing it, moving the cursor back to the line, and pressing RETURN.

If you're using the *Proofreader* on the 128, *do not perform any GRAPHIC commands while the* Proofreader *is active*. When you perform a command like GRAPHIC 1, the computer moves everything at the start of BASIC program space—including the *Proofreader*—to another memory area, causing the *Proofreader* to crash. The same thing happens if you run any program with a GRAPHIC command while the *Proofreader* is in memory.

Though the *Proofreader* doesn't interfere with other BASIC operations, it's a good idea to disable it before running another program. The simplest way to disable it is to turn the computer off then on. A gentler method is to SYS to the computer's built-in reset routine (65341 for the 128, 64738 for the 64). These reset routines erase any program in memory, so be sure to save the program you're typing in before entering the SYS command.

When using the *Proofreader* with another utility, disable *both* programs before running a BASIC program. While the *Proofreader* seems unaffected by most utilities, there's no way to promise it will work with any and every combination of utilities you might want to use. The more utilities activated, the more fragile the system becomes.

The Automatic Proofreader

```
10 VE=PEEK(772)+256*PEEK(773):LO
   =43:HI=44:PRINT "{CLR}{WHT}AU
   TOMATIC PROOFREADER FOR ";
20 IF VE=42364 THEN PRINT"C-64"
30 IF VE=17165 THEN LO=45:HI=46:
   WAIT CLR:PRINT "128"
40 SA=(PEEK(LO)+256*PEEK(HI))+6:
   FOR J=SA TO SA+166:READ B:POK
   E J,B:CH=CH+B:NEXT
50 IF CH<>20570 THEN PRINT "*ERR
   OR* CHECK TYPING IN DATA STAT
   EMENTS":END
60 FOR J=1 TO 5:READ RF,LF,HF:RS
   =SA+RF:HB=INT(RS/256):LB=RS-(
   256*HB)
70 CH=CH+RF+LF+HF:POKE SA+LF,LB:
   POKE SA+HF,HB:NEXT
80 IF CH<>22054 THEN PRINT "*ERR
   OR* RELOAD PROGRAM AND CHECK
   {SPACE}FINAL LINE":END
90 IF VE=17165 THEN POKE SA+14,2
   2:POKE SA+18,23:POKESA+29,224
   :POKESA+139,224
100 POKE SA+149,PEEK(772):POKE S
   A+150,PEEK(773):PRINT "{CLR}P
   ROOFREADER ACTIVE"
110 SYS SA:POKE HI,PEEK(HI)+1:PO
   KE (PEEK(LO)+256*PEEK(HI))-1,
   0:NEW
120 DATA120,169,73,141,4,3,169,3
   ,141,5,3,88,96,165,20,133,167
130 DATA165,21,133,168,169,0,141
   ,0,255,162,31,181,199,157,227
140 DATA3,202,16,248,169,19,32,2
   10,255,169,18,32,210,255,160
150 DATA0,132,180,132,176,136,23
   0,180,200,185,0,2,240,46,201
160 DATA34,208,8,72,165,176,73,2
   55,133,176,104,72,201,32,208
170 DATA7,165,176,208,3,104,208,
   226,104,166,180,24,165,167
180 DATA121,0,2,133,167,165,168,
   105,0,133,168,202,208,239,240
190 DATA202,165,167,69,168,72,41
   ,15,168,185,211,3,32,210,255
200 DATA104,74,74,74,74,168,185,
   211,3,32,210,255,162,31,189
210 DATA227,3,149,199,202,16,248
   ,169,146,32,210,255,76,86,137
220 DATA65,66,67,68,69,70,71,72,
   74,75,77,80,81,82,83,88
230 DATA13,2,7,167,31,32,151,116
   ,117,151,128,129,167,136,137
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How to Type In COMPUTE!'s Gazette Programs

Each month, *COMPUTE!'s Gazette* publishes programs for the Commodore 128 and 64. Each program is clearly marked by title and version. Be sure to type in the correct version for your machine. All 64 programs run on the 128 in 64 mode. Be sure to read the instructions in the corresponding article. This can save time and eliminate any questions which might arise after you begin typing.

We regularly publish two programs designed to make typing easier: *The Automatic Proofreader*, for BASIC programs, and *MLX*, for entering machine language programs.

When entering a BASIC program, be especially careful with DATA statements as they are extremely sensitive to errors. A mistyped number in a DATA statement can cause your machine to "lock up" (you'll have no control over the computer). If this happens, the only recourse is to turn your computer off and then on, erasing what was in memory. This could cause you to lose valuable data, so be sure to *save a program before you run it*. If your computer crashes, you can always reload the program and look for the error.

Special Characters

Most of the programs listed in each issue contain special control characters. To facilitate typing in any programs from *Gazette*, use the following listing conventions.

The most common type of control characters in our listings appear as words within braces: {DOWN} means to press the cursor-down key; {5 SPACES} means to press the space bar five times.

To indicate that a key should be shifted (hold down the SHIFT key while pressing another key), the character is underlined. For example, A means hold down the SHIFT key and press A. You may see strange characters on your screen, but that's to be expected. If you find a number followed by an underlined key enclosed in braces (for example, {8 A}), type the key as many times as indicated (in our example, enter eight shifted A's).

If a key is enclosed in special brackets, [ ], hold down the Commodore key (at the lower left corner of the keyboard) and press the indicated character.

Rarely, you'll see a single letter of the alphabet enclosed in braces. This can be entered on the Commodore 64 by pressing the CTRL key while typing the letter in braces. For example, {A} means to press CTRL-A.

The Quote Mode

Although you can move the cursor around the screen with the CRSR keys, often a programmer will want to move the cursor under program control. This is seen in examples such as {LEFT} and {HOME} in the program listings. The only way the computer can tell the difference between direct and programmed cursor control is the *quote mode*.

Once you press the quote key, you're in quote mode. This mode can be confusing if you mistype a character and cursor left to change it. You'll see a graphics symbol for cursor left. In this case, you can use the DEL key to back up and edit the line. Type another quotation mark and you're out of quote mode. If things really get confusing, you can exit quote mode simply by pressing RETURN. Then just cursor up to the mistyped line and fix it.

When You Read:	Press:	See:
{CLR}	SHIFT + CLR/HOME	
{HOME}	CLR/HOME	
{UP}	SHIFT + ↑ CRSR ↓	
{DOWN}	↑ CRSR ↓	
{LEFT}	SHIFT + ← CRSR →	
{RIGHT}	← CRSR →	
{RVS}	CTRL 9	
{OFF}	CTRL 0	
{BLK}	CTRL 1	
{WHT}	CTRL 2	
{RED}	CTRL 3	
{CYN}	CTRL 4	

When You Read:	Press:	See:
{PUR}	CTRL 5	
{GRN}	CTRL 6	
{BLU}	CTRL 7	
{YEL}	CTRL 8	
{ F1 }	f1	
{ F2 }	SHIFT f1	
{ F3 }	f3	
{ F4 }	SHIFT f3	
{ F5 }	f5	
{ F6 }	SHIFT f5	
{ F7 }	f7	
{ F8 }	SHIFT f7	

When You Read:	Press:	See:
←	←	
↑	SHIFT ↑	

For Commodore 64 Only

[1]	COMMODORE 1	
[2]	COMMODORE 2	
[3]	COMMODORE 3	
[4]	COMMODORE 4	
[5]	COMMODORE 5	
[6]	COMMODORE 6	
[7]	COMMODORE 7	
[8]	COMMODORE 8	

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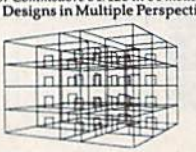

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MLX Machine Language Entry Program for Commodore 64

Ottis R. Cowper

MLX is a labor-saving utility that allows almost fail-safe entry of Commodore 64 machine language programs.

Type in and save some copies of *MLX*—you'll want to use it to enter future ML programs from *COMPUTE!'s Gazette*. When you're ready to enter an ML program, load and run *MLX*. It asks you for a starting address and an ending address. These addresses appear in the article accompanying the *MLX*-format program listing you're typing.

If you're unfamiliar with machine language, the addresses (and all other values you enter in *MLX*) may appear strange. Instead of the usual decimal numbers you're accustomed to, these numbers are in *hexadecimal*—a base 16 numbering system commonly used by ML programmers. Hexadecimal—hex for short—includes the numerals 0–9 and the letters *A–F*. But even if you know nothing about ML or hex, you should have no trouble using *MLX*.

After you've entered the starting and ending addresses, you'll be offered the option of clearing the workspace. Choose this option if you're starting to enter a new listing. If you're continuing a listing that's partially typed from a previous session, don't choose this option.

A functions menu will appear. The first option in the menu is Enter Data. If you're just starting to type in a program, pick this. Press the E key and type the first number in the first line of the program listing. If you've already typed in part of a program, type the line number where you stopped typing at the end of the previous session (be sure to load the partially completed program before you resume entry). In any case, make sure the address you enter corresponds to the address of a line in the listing you are entering. Otherwise, you'll be unable to enter the data correctly. If you pressed E by mistake, you can return to the command menu by pressing RETURN alone when asked for the address. (You can get back to the menu from most options by pressing RETURN with no other input.)

Entering a Listing

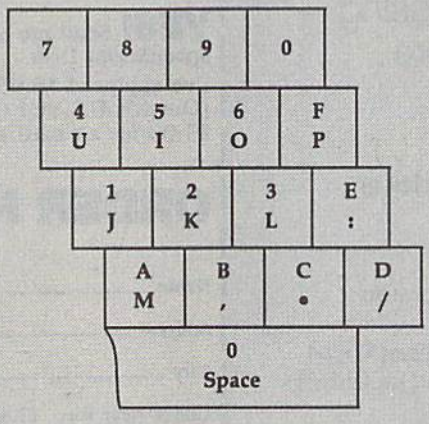
Once you're in Enter mode, *MLX* prints the address for each program line for you. You then type in all nine numbers on that line, beginning with the first two-digit number after the colon (:). Each line represents eight data bytes and a checksum. Although an *MLX*-format listing appears similar to the "hex dump" listings from a machine language monitor program, the extra checksum number on the end allows *MLX* to check your typing.

When you enter a line, *MLX* recalculates the checksum from the eight bytes and the address and compares this value to the number from the ninth column. If the values match, you'll hear a bell tone, the data will be added to the workspace area, and the prompt for the next line of data will appear. But if *MLX* detects a typing error, you'll hear a low buzz and see an error message. The line will then be redisplayed for editing.

Invalid Characters Banned

Only a few keys are active while you're entering data, so you may have to unlearn some habits. You *do not* type spaces between the columns; *MLX* automatically inserts these for you. You *do not* press RETURN after typing the last number in a line; *MLX* automatically enters and checks the line after you type the last digit.

Only the numerals 0–9 and the letters *A–F* can be entered. If you press any other key (with some exceptions noted below), you'll hear a warning buzz. To simplify typing, a numeric keypad function is included. The keypad is active only while entering data. Addresses must be entered with the normal letter and number keys. The figure below shows the keypad configuration.



MLX checks for transposed characters. If you're supposed to type in A0 and instead enter 0A, *MLX* will catch your mistake. There is one error that can slip past *MLX*: Because of the checksum formula used, *MLX* won't notice if you accidentally type FF in place of 00, and vice versa. And there's a very slim chance that you could garble a line and still end up with a combination of characters that adds up to the proper checksum. However, these mistakes should not occur if you take reasonable care while entering data.

Editing Features

To correct typing mistakes before finishing a line, use the INST/DEL key to delete the character to the left of the cursor. If you mess up a line badly, press CLR/HOME to start the line over. The RETURN key is also active, but only before any data is typed on a line. Pressing RETURN at this point returns you to the command menu. After you type a character, *MLX* disables RETURN until the cursor returns to the start of a line. Remember, press CLR/HOME to quickly get to a line-number prompt.

To make corrections in a line that *MLX* has redisplayed for editing, compare the line on the screen with the one printed in the listing and then move the cursor to the mistake and type the correct key. The cursor-left and -right keys provide the normal cursor controls. (The INST/DEL key now works as an alternative cursor-left key.) You cannot move left beyond the first character in the line. If you try to move beyond the rightmost character, you'll reenter the line. During editing, RETURN is active; pressing it tells *MLX* to recheck the line. You can press the CLR/HOME key to clear the entire line if you want to start from scratch or if you want to get to a line-number prompt to use RETURN to get back to the menu.

Display Data

The second menu choice, Display Data, examines memory and shows the contents in the same format as the program listing (including the checksum). When you press D, *MLX* asks you for a starting address. Be sure that the starting address you give corresponds to a line number in the listing. Otherwise, the checksum display will be meaningless. *MLX* displays program lines until it reaches the end of the program, at which point the menu is redisplayed. You can pause the display by pressing the space bar. (*MLX* finishes printing the current line before halting.) Press the space bar again to restart the display. To break out of the display and get back to the menu before the ending address is reached, press RETURN.

Other Menu Options

Two more menu selections let you save programs and load them back into the computer. These are Save File and Load File. When you press S or L, *MLX* asks you for the filename. You'll then be asked to press either D or T to select disk or tape.

You'll notice the disk drive starting and stopping several times during a load or save. This is normal behavior. *MLX* opens and reads from or writes to the file instead of using the usual LOAD and SAVE commands. Also note that the drive prefix 0: is added to the filename (line 750), so this should *not* be included when entering the name. This also precludes the use of @ for save-with-replace, so be sure to give each version saved a different name.

Remember that *MLX* saves the entire workspace area from the starting address to the ending address, so the save or load may take longer than you might expect if you've entered only a small amount of data from a long listing. When you're saving a partially completed listing, make sure to note the address where you stopped typing.

MLX reports the standard disk or tape error messages if any problems are detected during the save or load. It also has three special load error messages: INCORRECT STARTING ADDRESS, which means the file you're trying to load does not have the starting address you specified when you ran *MLX;* LOAD ENDED AT *address*, which means the file you're trying to load ends before the ending address you specified when you started *MLX;* and TRUNCATED AT ENDING ADDRESS, which means the file you're trying to load extends beyond the ending address you specified when you started *MLX*. If you see one of these messages and feel certain that you've loaded the right file, exit and rerun *MLX*, being careful to enter the correct starting and ending addresses.

The Quit menu option has the obvious effect—it stops *MLX* and enters BASIC. The RUN/STOP key is disabled, so the Q option lets you exit the program without turning off the computer. (Of course, RUN/STOP-RESTORE also gets you out.) You'll be asked for verification; press Y to exit to BASIC, or press any other key to return to the menu. After quitting, you can type RUN again and reenter *MLX* without losing your data, as long as you don't use the Clear Workspace option.

The Finished Product

When you've finished typing all the data for an ML program and saved your work, you're ready for the results. Refer to the corresponding article for details on loading and running the program.

An Ounce of Prevention

By the time you've finished typing in the data for a long ML program, you may have several hours invested in the project. Don't take chances—use *The Automatic Proofreader* to type the new *MLX*, and then test your copy *thoroughly* before first using it to enter any significant amount of data. Make sure all the menu options work as they should. Enter fragments of the program starting at several different addresses; then use the display option to verify that the data has been entered correctly. And be sure to test the save and load options several times to ensure that you can recall your work from disk or tape.

64 MLX

```
EK 100 POKE 56,50:CLR:DIM IN$,I,
       J,A,B,A$,B$,A(7),N$
DM 110 C4=48:C6=16:C7=7:Z2=2:Z4=
       254:Z5=255:Z6=256:Z7=127
CJ 120 FA=PEEK(45)+Z6*PEEK(46):B
       S=PEEK(55)+Z6*PEEK(56):H$
       ="0123456789ABCDEF"
SB 130 R$=CHR$(13):L$="{LEFT}":S
       $=" ":D$=CHR$(20):Z$=CHR$
       (0):T$="{13 RIGHT}"
CQ 140 SD=54272:FOR I=SD TO SD+2
       3:POKE I,0:NEXT:POKE SD+2
       4,15:POKE 788,52
FC 150 PRINT"{CLR}"CHR$(142)CHR$
       (8):POKE 53280,15:POKE 53
       281,15
EJ 160 PRINT T$" {RED}{RVS}
       {2 SPACES}{8 @}{2 SPACES}
       "SPC(28)"{2 SPACES}{OFF}
       {BLU} MLX II {RED}{RVS}
       {2 SPACES}"SPC(28)"
       {12 SPACES}{BLU}"
FR 170 PRINT"{3 DOWN}{3 SPACES}C
       OMPUTE!'S MACHINE LANGUAG
       E EDITOR{3 DOWN}"
JB 180 PRINT"{BLK}STARTING ADDRE
       SS{4}";:GOSUB300:SA=AD:GO
       SUB1040:IF F THEN180
GF 190 PRINT"{BLK}{2 SPACES}ENDI
       NG ADDRESS{4}";:GOSUB300:
       EA=AD:GOSUB1030:IF F THEN
       190
KR 200 INPUT"{3 DOWN}{BLK}CLEAR
       {SPACE}WORKSPACE [Y/N]{4}
       ";A$:IF LEFT$(A$,1)<>"Y"T
       HEN220
PG 210 PRINT"{2 DOWN}{BLU}WORKIN
       G...";:FORI=BS TO BS+EA-S
       A+7:POKE I,0:NEXT:PRINT"D
       ONE"
DR 220 PRINTTAB(10)"{2 DOWN}
       {BLK}{RVS} MLX COMMAND ME
       NU {DOWN}{4}":PRINT T$"
       {RVS}E{OFF}NTER DATA"
BD 230 PRINT T$"{RVS}D{OFF}ISPLA
       Y DATA":PRINT T$"{RVS}L
       {OFF}OAD FILE"
JS 240 PRINT T$"{RVS}S{OFF}AVE F
       ILE":PRINT T$"{RVS}Q{OFF}
       UIT{2 DOWN}{BLK}"
JH 250 GET A$:IF A$=N$ THEN250
HK 260 A=0:FOR I=1 TO 5:IF A$=MI
       D$("EDLSQ",I,1)THEN A=I:I
       =5
FD 270 NEXT:ON A GOTO420,610,690
       ,700,280:GOSUB1060:GOTO25
       0
EJ 280 PRINT"{RVS} QUIT ":INPUT"
       {DOWN}{4}ARE YOU SURE [Y/
       N]";A$:IF LEFT$(A$,1)<>"Y
       "THEN220
EM 290 POKE SD+24,0:END
JX 300 IN$=N$:AD=0:INPUTIN$:IFLE
       N(IN$)<>4THENRETURN
KF 310 B$=IN$:GOSUB320:AD=A:B$=M
       ID$(IN$,3):GOSUB320:AD=AD
       *256+A:RETURN
PP 320 A=0:FOR J=1 TO 2:A$=MID$(
       B$,J,1):B=ASC(A$)-C4+(A$>
       "@")*C7:A=A*C6+B
JA 330 IF B<0 OR B>15 THEN AD=0:
       A=-1:J=2
GX 340 NEXT:RETURN
CH 350 B=INT(A/C6):PRINT MID$(H$
       ,B+1,1);:B=A-B*C6:PRINT M
       ID$(H$,B+1,1);:RETURN
RR 360 A=INT(AD/Z6):GOSUB350:A=A
       D-A*Z6:GOSUB350:PRINT":";
BE 370 CK=INT(AD/Z6):CK=AD-Z4*CK
       +Z5*(CK>Z7):GOTO390
PX 380 CK=CK*Z2+Z5*(CK>Z7)+A
JC 390 CK=CK+Z5*(CK>Z5):RETURN
QS 400 PRINT"{DOWN}STARTING AT
       {4}";:GOSUB300:IF IN$<>N$
       THEN GOSUB1030:IF F THEN
       400
EX 410 RETURN
HD 420 PRINT"{RVS} ENTER DATA ":
       GOSUB400:IF IN$=N$ THEN22
       0
JK 430 OPEN3,3:PRINT
SK 440 POKE198,0:GOSUB360:IF F T
       HEN PRINT IN$:PRINT"{UP}
       {5 RIGHT}";
GC 450 FOR I=0 TO 24 STEP 3:B$=S
       $:FOR J=1 TO 2:IF F THEN
       {SPACE}B$=MID$(IN$,I+J,1)
HA 460 PRINT"{RVS}"B$L$;:IF I<24
       THEN PRINT"{OFF}";
HD 470 GET A$:IF A$=N$ THEN470
FK 480 IF(A$>"/"ANDA$<":")OR(A$>
       "@"ANDA$<"G")THEN540
GS 485 A=-(A$="M")-2*(A$=",")-3*
       (A$=".")-4*(A$="/")-5*(A$
       ="J")-6*(A$="K")
FX 486 A=A-7*(A$="L")-8*(A$=":")
       -9*(A$="U")-10*(A$="I")-1
       1*(A$="O")-12*(A$="P")
CM 487 A=A-13*(A$=S$):IF A THEN
       {SPACE}A$=MID$("ABCD123E4
       56F0",A,1):GOTO 540
MP 490 IF A$=R$ AND((I=0)AND(J=1
       )OR F)THEN PRINT B$;:J=2:
       NEXT:I=24:GOTO550
KC 500 IF A$="{HOME}" THEN PRINT
        B$:J=2:NEXT:I=24:NEXT:F=
       0:GOTO440
MX 510 IF(A$="{RIGHT}")ANDF THEN
       PRINT B$L$;:GOTO540
GK 520 IF A$<>L$ AND A$<>D$ OR((
       I=0)AND(J=1))THEN GOSUB10
       60:GOTO470
HG 530 A$=L$+S$+L$:PRINT B$L$;:J
       =2-J:IF J THEN PRINT L$;:
       I=I-3
QS 540 PRINT A$;:NEXT J:PRINT S$
       ;
PM 550 NEXT I:PRINT:PRINT"{UP}
       {5 RIGHT}";:INPUT#3,IN$:I
       F IN$=N$ THEN CLOSE3:GOTO
       220
QC 560 FOR I=1 TO 25 STEP3:B$=MI
       D$(IN$,I):GOSUB320:IF I<2
       5 THEN GOSUB380:A(I/3)=A
PK 570 NEXT:IF A<>CK THEN GOSUB1
       060:PRINT"{BLK}{RVS} ERRO
       R: REENTER LINE {4}":F=1:
       GOTO440
HJ 580 GOSUB1080:B=BS+AD-SA:FOR
       {SPACE}I=0 TO 7:POKE B+I,
       A(I):NEXT
QQ 590 AD=AD+8:IF AD>EA THEN CLO
       SE3:PRINT"{DOWN}{BLU}** E
       ND OF ENTRY **{BLK}
       {2 DOWN}":GOTO700
GQ 600 F=0:GOTO440
```

```
QA 610 PRINT"{CLR}{DOWN}{RVS} DI
       SPLAY DATA ":GOSUB400:IF
       {SPACE}IN$=N$ THEN220
RJ 620 PRINT"{DOWN}{BLU}PRESS:
       {RVS}SPACE{OFF} TO PAUSE,
        {RVS}RETURN{OFF} TO BREA
       K{4}{DOWN}"
KS 630 GOSUB360:B=BS+AD-SA:FORI=
       BTO B+7:A=PEEK(I):GOSUB35
       0:GOSUB380:PRINT S$;
CC 640 NEXT:PRINT"{RVS}";:A=CK:G
       OSUB350:PRINT
KH 650 F=1:AD=AD+8:IF AD>EA THEN
       PRINT"{DOWN}{BLU}** END O
       F DATA **":GOTO220
KC 660 GET A$:IF A$=R$ THEN GOSU
       B1080:GOTO220
EQ 670 IF A$=S$ THEN F=F+1:GOSUB
       1080
AD 680 ONFGOTO630,660,630
CM 690 PRINT"{DOWN}{RVS} LOAD DA
       TA ":OP=1:GOTO710
PC 700 PRINT"{DOWN}{RVS} SAVE FI
       LE ":OP=0
RX 710 IN$=N$:INPUT"{DOWN}FILENA
       ME{4}";IN$:IF IN$=N$ THEN
       220
PR 720 F=0:PRINT"{DOWN}{BLK}
       {RVS}T{OFF}APE OR {RVS}D
       {OFF}ISK: {4}";
FP 730 GET A$:IF A$="T"THEN PRIN
       T"T{DOWN}":GOTO880
HQ 740 IF A$<>"D"THEN730
HH 750 PRINT"D{DOWN}":OPEN15,8,1
       5,"I0:":B=EA-SA:IN$="0:"+
       IN$:IF OP THEN810
SQ 760 OPEN 1,8,8,IN$+",P,W":GOS
       UB860:IF A THEN220
FJ 770 AH=INT(SA/256):AL=SA-(AH*
       256):PRINT#1,CHR$(AL);CHR
       $(AH);
PE 780 FOR I=0 TO B:PRINT#1,CHR$
       (PEEK(BS+I));:IF ST THEN8
       00
FC 790 NEXT:CLOSE1:CLOSE15:GOTO9
       40
GS 800 GOSUB1060:PRINT"{DOWN}
       {BLK}ERROR DURING SAVE:
       {4}":GOSUB860:GOTO220
MA 810 OPEN 1,8,8,IN$+",P,R":GOS
       UB860:IF A THEN220
GE 820 GET#1,A$,B$:AD=ASC(A$+Z$)
       +256*ASC(B$+Z$):IF AD<>SA
        THEN F=1:GOTO850
RX 830 FOR I=0 TO B:GET#1,A$:POK
       E BS+I,ASC(A$+Z$):IF(I<>B
       )AND ST THEN F=2:AD=I:I=B
FA 840 NEXT:IF ST<>64 THEN F=3
FQ 850 CLOSE1:CLOSE15:ON ABS(F>0
       )+1 GOTO960,970
SA 860 INPUT#15,A,A$:IF A THEN C
       LOSE1:CLOSE15:GOSUB1060:P
       RINT"{RVS}ERROR: "A$
GQ 870 RETURN
EJ 880 POKE183,PEEK(FA+2):POKE18
       7,PEEK(FA+3):POKE188,PEEK
       (FA+4):IFOP=0THEN920
HJ 890 SYS 63466:IF(PEEK(783)AND
       1)THEN GOSUB1060:PRINT"
       {DOWN}{RVS} FILE NOT FOUN
       D ":GOTO690
CS 900 AD=PEEK(829)+256*PEEK(830
       ):IF AD<>SA THEN F=1:GOTO
       970
SC 910 A=PEEK(831)+256*PEEK(832)
       -1:F=F-2*(A<EA)-3*(A>EA):
       AD=A-AD:GOTO930
KM 920 A=SA:B=EA+1:GOSUB1010:POK
       E780,3:SYS 63338
JF 930 A=BS:B=BS+(EA-SA)+1:GOSUB
       1010:ON OP GOTO950:SYS 63
       591
AE 940 GOSUB1080:PRINT"{BLU}** S
       AVE COMPLETED **":GOTO220
XP 950 POKE147,0:SYS 63562:IF ST
       >0 THEN970
FR 960 GOSUB1080:PRINT"{BLU}** L
       OAD COMPLETED **":GOTO220
DP 970 GOSUB1060:PRINT"{BLK}
       {RVS}ERROR DURING LOAD:
       {DOWN}{4}":ON F GOSUB980,
       990,1000:GOTO220
PP 980 PRINT"INCORRECT STARTING
       {SPACE}ADDRESS (";:GOSUB3
       60:PRINT")":RETURN
GR 990 PRINT"LOAD ENDED AT ";:AD
       =SA+AD:GOSUB360:PRINT D$:
       RETURN
FD 1000 PRINT"TRUNCATED AT ENDIN
        G ADDRESS":RETURN
RX 1010 AH=INT(A/256):AL=A-(AH*2
        56):POKE193,AL:POKE194,A
        H
FF 1020 AH=INT(B/256):AL=B-(AH*2
        56):POKE174,AL:POKE175,A
        H:RETURN
FX 1030 IF AD<SA OR AD>EA THEN10
        50
HA 1040 IF(AD>511 AND AD<40960)O
        R(AD>49151 AND AD<53248)
        THEN GOSUB1080:F=0:RETUR
        N
HC 1050 GOSUB1060:PRINT"{RVS} IN
        VALID ADDRESS {DOWN}
        {BLK}":F=1:RETURN
AR 1060 POKE SD+5,31:POKE SD+6,2
        08:POKE SD,240:POKE SD+1
        ,4:POKE SD+4,33
DX 1070 FOR S=1 TO 100:NEXT:GOTO
        1090
PF 1080 POKE SD+5,8:POKE SD+6,24
        0:POKE SD,0:POKE SD+1,90
        :POKE SD+4,17
AC 1090 FOR S=1 TO 100:NEXT:POKE
         SD+4,0:POKE SD,0:POKE S
        D+1,0:RETURN                G
```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April—Omicron, Music Improvisor, *Print Shop* to GEOS, TurboSave 128, TurboSave 64, Countdown Timer
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REVIEWS

Space Rogue

It's getting progressively harder to pigeonhole computer games. Many of today's titles no longer fit into easily definable categories; instead they straddle the line between types. *Space Rogue* is one of the latest examples of this new breed of hybrids. Part flight simulator, part arcade game, part role-playing adventure, *Space Rogue* borrows features from all three genres, providing a gaming experience that's entertaining on multiple levels.

Its heritage may be diverse, but when it comes to subject matter, *Space Rogue* falls squarely into the space-opera tradition. All of the classic elements are here: bug-eyed aliens, artifacts from an ancient civilization, intergalactic intrigue and warfare, and enough techno-babble to fill a small dictionary. Set in a far-flung corner of a universe called—appropriately enough—the Far Arm, *Space Rogue* casts you in the role of a young adventurer hungry for fame and fortune. How you acquire both depends not only on your skills, but also on your scruples and daring.

> ***The* Space Rogue *universe is a responsive one, where actions carry short- and long-term consequences.***

The space-flight and dogfight routines in the game strike a nice balance between sophistication and fast-action thrills. Although piloting your Sunracer scout ship is easier than handling an F-15 jet fighter, the simulator portion of the program includes enough detail to keep hardcore space jockeys happy. Far from being a simple matter of jerking the joystick in different directions and pressing the fire button when the enemy is in sight, the combat sequences test your grasp of tactics and flight dynamics as much as your reflexes. Particularly crucial to your survival is an appreciation of how your weapon and defense systems match up against your opponent's.

The space battles provide for plenty of excitement in and of themselves. However, these encounters take on a larger meaning and significance within the context of your adventures on the various star bases and outposts scattered throughout the Far Arm. And it's this role-playing dimension that makes *Space Rogue* so engrossing and enjoyable to play.

Unlike many other games of its ilk, *Space Rogue* doesn't force you into a rigid path of behavior. Rather, it allows considerable latitude in choosing the role you wish to adopt. For instance, you can live up to the game's title and act like a pirate, preying on hapless merchants, or you can remain a peaceful trader. In fact, this is one game where it often pays to avoid aggression. However, your feats do not take place in a vacuum. Your status in the eyes of the major factions operating in the Far Arm rises and falls according to your deeds. The *Space Rogue* universe is a responsive one, where actions carry short- and long-term consequences.

Space Rogue also benefits from some appealing packaging, which serves to enrich your experience in a small but meaningful way. Long gone are the days when computer games consisted of a disk and a rules pamphlet—this box is packed with goodies. Its contents include a full-color map of the Far Arm star cluster, an introductory short story, paper cutout models of different starships, and an instruction booklet presented in the form of a stained, well-thumbed, and annotated Sunracer Owner's Manual. Of course, the game plays the same regardless of their presence, but these playing aids affect the perception of the value you receive for your money. More importantly, a game like *Space Rogue* is also an exercise in escapism, and its small array of components only helps to reinforce this illusion.

Space Rogue breaks no new ground as a flight simulator or a role-playing adventure, and its story line follows a path already trod by numerous sci-fi yarns. This is another way of saying that *Space Rogue* builds on a solid foundation of what's come before, both in the realm of computer games and the space-opera subgenre of science fiction. It may not offer anything startlingly fresh, but assuming your expectations are in line with the game's ambitions, neither will it disappoint you.

—Jeff Seiken

Space Rogue
Origin
136-B Harvey Rd.
Londonderry, NH 03053
$49.95

Scrabble

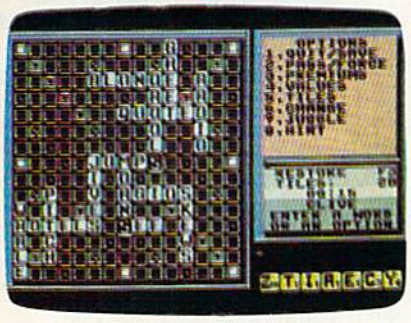
We've never before sat down to play Scrabble with a dictionary in one hand and an AK-47 in the other. Now, however, there's no other way. We're being tutored in the nastiest, most cutthroat game we've ever seen.

In designing this computer version of the classic Scrabble crossword game, Leisure Genius has, in some ways, surpassed the original game. All the elements of the board game are here: the limited number of letters, the blank tiles, the double and triple letter and word spaces, and the tile values. Up to four people can play, and players can be any combination from no humans (all computer players) to all humans. Play is pretty much the same as in the board version, although the program brings in a couple of features that add a fillip to the game.

For instance, when you try out a word, you type it in, place the cursor, and tell the computer whether to lay it across or down. It does so, and then calculates and displays the score earned for that word. It then gives you the option of using the word or trying another. If you opt to use the word and it does not match anything in the game's 20,000-word dictionary (*The Official Scrabble Player's Dictionary* and *Chamber's*

Words), it will challenge the word. You can override the challenge, since it's possible to use a perfectly valid word that's not in the program's dictionary. If you can't justify your word, you forfeit your turn.

The game also has a clock you can either set to limit turn time (anything from 10 seconds to 9 minutes 59 seconds) or turn off entirely. In conjunction with that is a "force" key you can use to speed up the computer's turn by forcing it to use a word it is considering. You can opt to view all the tile racks (which doesn't particularly help) or



only the rack of the current player, and you can choose to watch the computer thinking as it considers words to play.

Now, playing against other humans is not terribly different from playing the board version, and it certainly is not cause for undue anxiety or violence. So why the armaments of dictionary and

> *Bring your dictionary and an AK-47 to play this game.*

military assault rifle we mentioned at the top of this review? Because of the computer!

This version of Scrabble allows one human to take on from one to three computer players. Computer players, mind you, have access to that 20,000-word dictionary—a dictionary you are unlikely ever to view, a dictionary that contains words never dreamed of by your humble Webster's *Ninth New Collegiate,* words you'd challenge if your own grandmother attempted to use them, and words you'd never think to put on the screen. When was the last time you dared to try using *ai* (a sloth with three claws on each front foot), *zee* (the letter Z, for crying out loud), or *noo* (we never did find out what that means)? Unfortunately, you cannot challenge the computer player's words. We'd like to see that made possible, so the computer will tell you what some of those words mean.

Most humans take offense at being one-upped by a computer. We're no exception. In fact, we don't just take offense, we get mad! How would you feel about a computer that used all of its letters right off the bat to take the lead with a 50-point bonus? Exactly. Such behavior brings out the vicious competitor in us. We don't like being beaten, and we really don't like being beaten by a machine—which is why our AK-47 stays pointed at our 64 when *Scrabble* is running.

Scrabble is a great game to take home, a great way to hone your playing and vocabulary skills. In a couple of weeks, you'll have the confidence to take on your neighbors, having built up a vocabulary of obscure, but valid, high-scoring words. Rub your hands with glee at the thought of clobbering the Joneses. Maybe you'll even play for cash. But leave the gun at home.

—David and Robin Minnick

Scrabble
Virgin Mastertronic
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Costa Mesa, CA 92627
$29.99

Sgt. Slaughter's Mat Wars

In adopting a behind-the-scenes viewpoint of the sport of wrestling, *Sgt. Slaughter's Mat Wars* succeeds in adding depth to the game by taking into account some of the contortions that take place outside the ring.

Your first step in playing will be to select a manager from a field of five. Each has a different personality and background, although these seem to have no bearing on their eventual conduct. (Wrestling star Sgt. Slaughter himself has no bearing on the game either, other than lending his dubious name to the package and summing up each match.)

Once you've chosen a manager, your next step is to buy a wrestler. Placed on an auction block like sides of beef, fighters are sold to the highest bidder. Though you have a beginning budget of $15,000, you'll want to remember that each match has an entry fee of $1,000 and you'll want to have some reserve for making bets on the actual match.

The best strategy is to outbid your rivals for the first offering. Later auction entries have lower energy levels and are less suited for winning any bouts.

Now you're ready for the meat of the game: betting on your fighter. Unless you can get good odds, it won't pay to bet against your own man. Bets are in increments of $100 with a maximum bet of $500. At even money, taking a dive will only win you back half your entry fee.

You can plan for a long-range strategy by fixing other fights in order to force future opponents out of the

> *Fix fights to force future opponents out of the running, leaving your man to face a field of pussycats.*

running, thereby leaving your man to face a field of pussycats. Obviously, there is a price involved in fixing, and at the early stages of the game, you're still working off your original budget.

After all this, the actual wrestling may seem a secondary activity. However, with four levels of combat, each of which changes the moves available to your fighter with your joystick, the wrestling involves a great deal of concentration as well as eye/hand coordination.

By succeeding in level 1, where the movements are a punch, a knee lift, an elbow to the rear, and running, you reach level 2. Here, a knockout punch takes the place of the level 1 punch, and bending down replaces the knee lift. In level 3, you'll work with body slams, pile drivers, and throwing your oppo-

nent into the ropes. The last level allows you to pin your opponent.

In the heat of the moment, it's sometimes difficult to remember where you are and what you're doing—much like a real wrestler who has been dropped on his head too often. If you win in the first level of competition, the purse is $25,000 and you can move up through the ranks to compete on a higher level, where the reward can be as high as $75,000. Such a purse gives your manager more money with which to bet and to fix fights.

Sgt. Slaughter's Mat Wars features good graphics and animation, with sound that is acceptable but not exciting. An interesting transitional device takes you from auction block to bullpit

to coliseum. You'll see a broad view of the scene and then, in a zoom sequence, zero in on the place of action.

I don't think *Mat Wars* will be considered one of the great games, but in the routines of betting and fixing fights, it adds the necessity of long-range strategy as well as hinting at a certain sleaziness that may or may not exist in the real world of professional wrestling. This facet lifts it above the level of similar fighting-only computer games.

—Ervin Bobo

Sgt. Slaughter's Mat Wars
Mindscape
3444 Dundee Rd.
Northbrook, IL 60062
$29.95

Mean Streets

In *Mean Streets*, an interactive detective movie set in the year 2033, you assume the identity of a seedy private investigator in the shadowy world of postwar San Francisco. It's a dark place, literally and figuratively. The title refers to the streets of the cities, abandoned to the vermin—human and barely human—by those wealthy enough to own flying cars.

As you suffer through a tedious afternoon, a beautiful woman walks into your life, providing you with a case as puzzling as anything Marlowe or Spade had to deal with a century earlier. Her father, Dr. Carl Linsky, apparently has committed suicide—but she has her doubts.

Mean Streets *is a beautifully crafted detective story with surprisingly good graphics and a bonus of action modules.*

As you begin your investigation, all you know for sure is that Linsky is dead, his daughter is beautiful, and his exfiancée is not. The daughter is convinced that her father (an eminent professor of neuropsychology at the University of San Francisco) was murdered—but then, she is the beneficiary of a big life insurance policy. She stands to collect a tidy sum if the police's suicide theory can be disproved.

Before the case is over, you'll sniff around the back alleys of a city that's slowly reverting to barbarism, engage in running gun battles with faceless gunmen armed with semiautomatics, and search for clues. You are filled with an increasing sense of menace as you discover the possible involvement of a group of crypto Nazis and a monolithic multinational corporation.

What is the peculiar attraction that bound the late professor to his porcine fiancée? Who is the mysterious *SF* who left the last message on the dead man's fax? *Professor: You were right about these boys. They play for keeps. Watch your step.*

Naturally, in a world where radiation alerts have replaced the smog reports as a topic of casual chitchat, you will never expose yourself to the outside air—unless you're going to jump off a bridge. Instead, you pilot an automated flying car known as a speeder. And it's fast. If you're a diehard flight-simulator pilot, you can fly the speeder yourself. If you're interested only in finding the truth about Dr. Linsky's death, your speeder is equipped with an autopilot. You only have to enter the coordinates of your destination and then sit back for a simulated flight through the murky yellow skies. (To speed up the speeder a little, turn off the sound.)

The characters are scanned images able to display many expressions. Two characters (your secretary and a professional snitch) actually lipsync their words. Your secretary, Vanessa, has a not-too-secret crush on you and will find information quickly, if it's on file. Lee Chin, your informant, wants cash for information that often turns out to be the same as that which Vanessa provides for free. Check with Vanessa first and only bribe Lee for information when there's no other way to get it. (You'll find that Lee is acquainted with most of the "bad guys," and Vanessa has data on most of the "good guys" on file.)

Some gun battles must be won in order to reach a suspect, and some are just thrown in for a challenge. To win a gun battle, move forward, fire twice, duck the gunmen's bullets, stand up, move forward rapidly, and fire twice again. This tactic should help you survive the fusillade.

Be sure to search thoroughly. Most of your problems will probably result from cursory searches. You're given a menu of several things you can do with any discovered object—move it, take it, look at it, and so on. Be sure to perform each operation on each object. You never know when an important clue or object will turn up.

Furthermore, question each of the nearly 40 characters about every character or item of which you have knowledge. If you neglect to interrogate a person about something, you might miss an important clue—or a humorous aside. There is more than one route through the game, so don't be surprised if your path diverges from a friend's.

Mean Streets provides plot twists of the sort that make me stay up past midnight to watch *The Maltese Falcon* and *The Big Sleep* every time they're scheduled on TV's Insomniac Theater. *Mean Streets* is a well-conceived and beautifully crafted detective story providing a friendly, easily understood interface and surprisingly good graphics, with a bonus of action modules and a simple flight simulator. When you've mastered *Mean Streets*, look forward to the sequels planned for later this year.

—Robert Bixby

Mean Streets
Access Software
545 W. 500th S
Bountiful, UT 84010
$39.95 **G**

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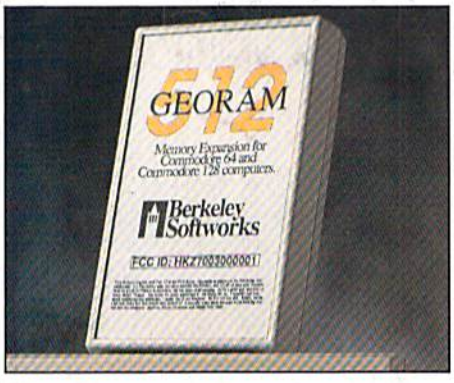

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